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Petite women: fit and body shape analysis

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PETITE WOMEN: FIT AND BODY SHAPE ANALYSIS

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in the partial fulfillment of the
requirements for the degree of
Master of Science

in

The School of Human Ecology

by

Lisa Barona McRoberts
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ABSTRACT

Only small quantities of apparel are available to the domestic petite sector, and they do not fit well due to lack of attention to proportion. In addition, other factors contributing to improper fit are a sizing system based on outdated anthropometric data gathered in the 1930s to create the voluntary product standard PS 42-70, and a rising obesity problem, resulting in an array of figure type variations ranging from apple-shaped to pear-shaped women, as opposed to the industry focused hourglass shape.

The purpose of this exploratory study was to investigate fit and design with figure type variations for petite women, five feet four inches or under, and between the ages of 20-49. Using a proprietary database, patterns were developed, muslins were created, and fit of the muslins was assessed by a panel of judges on live models. An evaluation about the fit of the muslins was completed by fit models. Results of the statistical analysis showed a sample mean distribution most similar to the size 16 petite of the voluntary product standard PS 42-70, with a pear-like silhouette supported by the literature. Findings suggested that the prototypical petite pattern resulted in improved fit as compared to the pattern based on the voluntary product standard. Figure type analysis of the sample indicated that most subjects were outside the industry silhouette definitions. None had the industry standard hourglass silhouette, indicative of a lack of accommodation for the petite silhouette and figure type variations by the voluntary product standard PS 42-70.

CHAPTER 1

INTRODUCTION

The origination of fit can be traced back as far as twelfth century Europe where the evidence of “well-cut through the body: fitted clothing” was interpreted as an image of nobility (Waugh 1999, p. 3). It was then, that fit began to influence fashion. Despite the simplicity of the garments, the difference in fit resulted from a tailor’s desire to waste less cloth. By removing excess seam allowance or ease, the clothing began an evolution of closer-to-the-body, fitted apparel with lacing closures. It was used to change the appearance of and create “a new concept of beauty,” (Waugh 1999, p. 3).

Between 1851 and 1854, feminists, denied the right to vote, saw the confining silhouettes in fashion as a further symbol of oppression. They attempted the first dress reform by wearing the “Bloomer costume” named after Amelia Bloomer (Tortora and Eubank 1998, p. 256). “It consisted of a full-skirted, short dress placed over full trousers” and was received with ridicule (Tortora and Eubank 1998, p. 256). Although the style did not last, feminists continued to demand dress reform throughout the 19th century. Fit affected the lifestyle and comfort of women on a daily basis.

By the end of the twentieth century, women in the workplace and World War I influenced fit in fashion. The “styles for women...were shorter, less confining and more practical,” (Tortora and Eubank 1998, p.379). Fabric restrictions in World War II also influenced fashion. In addition, the restrictions helped promote American designers. Along with these influences came a change in the visible role of women. They began to dress with more masculine lines, wearing pants and looser fitting garments (Tortora and Eubank, 1998). These new roles for women in society led to a need for accommodating new demands in fit.

Given the importance of fit and its influence in fashion, it is apparent that consumers desire appropriately fitted apparel. However, women have difficulty buying garments off the rack primarily because they do not fit properly or flatter their body type. “Survey results by Kurt Salmon show that fifty percent of people say their clothing doesn’t fit,” (Ashdown, 2003, p. 1). Lack of fit costs the apparel industry millions, and is also interconnected with problematic sizing methods that determine the sizing systems and sizing categories (Ashdown, 2003). Some of the costs incurred because of ill-fitted garments include alterations, garment selection, customer dissatisfaction, and returns. Additional costs of improperly fitted garments include losses in the mail order and catalog businesses, lost sales, increased markdowns, and decreased turnover (Tamburrino, 1992c).

One factor of fit to consider is the aspect of consumer psychological self-imagery, which can mandate a specific size preference. “Some women will walk out empty-handed if they can’t fit into the size they want,” (Arthur 2003, p. 2). Additionally, some women blamed themselves and their bodies for the improper fit encountered instead of the garment, resulting in a negative body image (Alexander, 2000; Manuel, 2000).

Forty-seven percent of the women in the United States between the ages of 20 and 49 represent the petite sector, and are five feet four inches or under (U. S. Department of Commerce, 2000), and have fit problems. The style choices for petite women are very limited in quantity and variation. “It can be a nightmare for...short women to find clothes that fit them properly – let alone styles that are on the cutting edge of fashion,” (The long and short of it all 2003, p. 1).

Sizing is a secondary factor that influences garment fit. Sizing systems are primarily derived from measurements taken in the 1940s that did not account for current body proportions, were voluntary, and challenged by psychological self-imagery (Holzman, 1997; Arthur, 2003).

This voluntary sizing system allowed each designer to create his or her own dimensions for each desired size. The result was inconsistency in fit and sizing that both frustrated and confused female consumers, making it difficult for them to select appropriately fitted garments.

Another problem is an increasing amount of vanity sizing used by the apparel industry to actually manipulate women into purchasing their products. This occurs when a designer creates a pattern with dimensions for one size and labels it with a size that is one or more sizes smaller to make the consumer believe she is the desired size. Some design firms have used this practice over such a long time period that the consumer may be less aware she is getting larger because she fits into the same size.

Today technology is capable of providing improvements in apparel fit. Some of the tools for ensuring better fit in the future include body scanners for size customization, “target market surveys, virtual fit assessment, and wear testing” (Ashdown 2003, pp. 3-4). Tailored Clothing Technology Corporation (TCTC) has recently developed a body scanner and has begun a study called SizeUSA, collecting three-dimensional measurements, of 25,000 men and women in over 20 U.S. cities. The purpose was to create a new sizing standard for the American Society for Testing and Materials (ASTM) and private clients (Ashdown, 2003), thus restricting the disclosure of the data and results.

With more apparel production moving offshore to foreign competition, because of cheaper labor and business operation costs, specialization in fit and sizing may be key in retaining some domestic competitive advantage in the apparel industry (American Textile Manufacturers Institute, 2003; Pusit, 1998). It would be a tremendous asset to target the challenging size problems of prominent consumers, previously overlooked, in a largely consumer driven market (Kilduff, 2001). This is especially true of the maturing baby boomers, representative of a large part of the population (Shim and Bickle, 1993). An additional

advantage is that the ever-changing domestic consumer, with her high demand for a specialized sizing system to satisfy the vast array of figure type variations, is physically available in the United States. Therefore, improvement and implementation of sizing systems based on current population studies could be financially beneficial to domestic apparel firms (Ashdown, 2003).

A search of the literature resulted in few previous studies regarding the petite sector of the apparel industry. Limited information indicated that there was a fit problem in petite sizing, but there was little or no information regarding resolution of the problem. Fit should be an area of interest to the domestic apparel industry. This exploratory study was designed to begin the research process to examine fit problems, particularly with petite women.

Statement of the Problem

Only small quantities of apparel are available to the domestic petite sector, and they lack proper fit due to a lack of attention to proportion resulting in poor aesthetic value. In addition, other factors contributing to improper fit are a sizing system based on outdated anthropometric data from the voluntary product standard PS 42-70 created in the 1930s, and a rising obesity problem, resulting in an array of figure type variations ranging from apple-shaped to pear-shaped women, as opposed to the industry focused hourglass shape.

Purpose of the Study

The purpose of this exploratory study was to investigate fit and design with figure type variations for petite women, five feet four inches or under, and between the ages of 20-49.

Designers in the industry, manufacturers, retailers, and consumers will benefit from this study.

Objectives

Objective 1

Using a proprietary database, determine the mean body measurements and compare them to that of the industry standard hourglass silhouette.

Objective 2

Develop an industry pattern with body measurements based on the Misses Petite voluntary product standard PS 42-70, Body Measurements for the Sizing of Women's Patterns and Apparel (U. S. Department of Commerce, 1971, p. 9).

Objective 3

Compare measurements of the sample mean to those of the voluntary product standard for Misses Petite (Voluntary product standard PS 42-70, U.S. Department of Commerce, 1971, p. 9), to determine if there are differences and develop a prototypical petite pattern representative of the sample.

Objective 4

Using established criteria for apple-shaped and pear-shaped figure type variations:

- 1) calculate the mean for apple-shaped and pear-shaped figure type variations
- 2) determine figure type of each subject in the sample
- 3) modify the prototypical petite pattern for petite apple-shaped and pear-shaped

Objective 5

Develop muslin proofs of each pattern.

Objective 6

Evaluate fit with the following:

- 1) judges' assessment of fit of proofs on live models
- 2) models' assessment of fit of proofs

Hypotheses

Hypothesis I

There will be differences in the measurements of the industry standard hourglass silhouette and the sample mean.

Hypothesis II

There will be differences between the measurements of the voluntary product standard PS 42-70 petite pattern and the prototypical petite pattern in the: circumference of:

- a) the circumference of the bust
- b) the circumference of the waist
- c) the circumference of the hips
- d) the length of the neck to waist (back)
- e) the length of the waist to hip

Hypothesis III

There will be differences between the fit of voluntary product standard PS 42-70 petite muslin proof and the prototypical petite, apple-shaped petite, and pear-shaped petite muslin proof in the bust, waist and hips, and the length measurements of the neck to waist (back), and waist to hip as assessed by judges.

Hypothesis IV

There will be differences between the fit of voluntary product standard PS 42-70 petite muslin proof and the prototypical petite, apple-shaped petite, and pear-shaped petite muslin proof in the bust, waist and hips, and the length measurements of the neck to waist (back), and waist to hip as assessed by models.

Assumptions

It was assumed that the fit of apparel with respect to petite women, could be evaluated independently from considerations of comfort.

Delimitations

- 1) This study did not address comfort because the purpose and scope of the investigation was to examine the fit of apparel on petite women.

- 2) The measurements were collected from a non-probability sample of the petite sector.
- 3) There were a limited number of models that provided feedback.
- 4) There were a limited number of judges.

Limitations

- 1) The study did not account for fit problems caused by postural problems.
- 2) The height measurement was self-reported.

Definitions

Apple-shaped/Rectangular/Ruler/"Straight line" – a silhouette in which the waistline area is thicker than that of the hourglass silhouette, in the middle region of the torso between the bust and hiplines. Armstrong (1995, p. 37) terms this silhouette as, "Straight line: shoulders and hips are aligned, waist/hip difference is 8 inches or less," (with little or no indentation at the waistline).

Balance – consists of symmetrical (equal appearance across center) and asymmetrical (equal weight distribution across center).

Color – is defined by hue (color name), value (lightness/darkness), and intensity (brightness/dullness).

Crotch height – a measurement taken while seated on a flat surface wherein a ruler is placed vertically on the flat surface to measure the height from the bottom of the surface to the waistline.

Crotch length – a measurement originating at the center front waistline, proceeding downward between the legs, and back up to the center back waistline.

Design – is comprised of critical aspects of design principles and elements. The design principles include rhythm (harmony), emphasis, proportion (scale), balance, and unity. Design elements incorporate shape/form (silhouette), color, texture, and line. For the purpose of this

paper, fashionable appearance and age appropriateness were taken into consideration within the definition of design.

Emphasis – is a design characteristic that serves as the center of attention.

Fit - a properly fit garment hangs well, and does not wrinkle in any area. It lies smoothly over curves and is comfortable to wear. If the design of a style is proportionate to body measurements and takes into account the problem areas of the consumer, it can emphasize the physical strengths, limit or conceal attention to the physical weaknesses, and enhance the overall appearance.

Form - is three dimensional, meaning it has length, width and dept and refers to the silhouette.

Hourglass – a silhouette in which shoulders and hips are aligned, waist/hip difference is 13 inches or more (Armstrong, 1995). The term “hourglass” also refers to a silhouette used to describe the primary sizing standard adopted by the industry that evolved from measurements listed in the Voluntary product standard PS 42-70 (U.S. Department of Commerce, 1971).

Industry Petite - a petite pattern with dimensions that most closely represents the population average, using the standardized measurements provided by the industry, Standardized Pattern Measurement Chart for Women (Brackelsberg and Marshall, 1994; U. S. Department of Commerce, 1971).

Line – variations include straight, curved, diagonal, thick or thin, horizontal or vertical; expresses emotion, direction, and space division.

Pear-shaped – a silhouette in which the hipline area and upper thigh region is much fuller than that of the hourglass silhouette, but the upper torso/bust area is smaller than the hourglass silhouette with narrow shoulders (Armstrong, 1995). For the purpose of this study, the hips are 4 inches larger than the bust or more.

Petite – women that measure five feet four inches in height or under, consistent with the terminology “miss petite” used in the sizing standard adopted by the industry that evolved from measurements listed in the Voluntary product standard PS 42-70 (U.S. Department of Commerce, 1971) and (Brackelsberg and Marshall, 1994).

Proportion or scale – is the relationship between the parts of a design.

Prototypical Petite – consists of measurements derived from a client database to develop dimensions for a prototypical petite pattern representative of the average of the population in this study.

Rhythm or harmony – consists of color or pattern repetition that creates movement.

Shape – is two-dimensional and flat.

Size Categories – or size classifications - a range of different types of sizes that would be used for retail such as misses, petite, plus, and women’s.

Sizing System – a set of sizes comprised using similar theory and methodology.

Style – the distinctive lines and characteristics of a garment design, such as a-line (Brackelsberg and Marshall, 1994).

Texture – is the surface hand of a structure that conveys tactile touch.

Unity – incorporates repetitive lines and shape, as well as similar color hues and textures.

CHAPTER 2

REVIEW OF LITERATURE

This exploratory study examined fit of apparel on petite women aged 20 – 49 and five feet four inches or less in height. The review of literature focused on three areas: 1) apparel fit and figure type variations, 2) sizing, and 3) anthropometric studies.

Apparel Fit and Figure Type Variations

With the progression of time, garments have fluctuated in varying degrees of fit ranging from close-to-body to away from the body. For example, in the twentieth century American Claire McCardle, designed sportswear and casual clothes for Townley Frocks. These categories of apparel were fitted loosely because they were made of stretch knit fabrics. After 1940, she



Figure 1 – Christian Dior’s “New Look” silhouette
Martin and Koda 1995, p. 33.

designed independently. “Her clothing was considered radical at first and was difficult to sell, but when women found her designs fit them well and were comfortable, they looked for more of the same,” (Tortora and Eubank 1998, p. 392). In 1947, Parisian couturier Christian Dior (Figure 1). created a dramatic new direction called the “New



Figure 2 – CoCo Chanel’s liberating “Box Suit”
Tortora and Eubank 1998, p. 444.

Look” (Martin and Koda, p.33; Tortora and Eubank 1998, p.430). The silhouette was hourglass-shaped with a tightly cinched waist and reigned predominantly for ten years. This was because the shape of the silhouette was very flattering to women. However, another advocate of comfort and sportswear, Coco Chanel came out of retirement and reopened her couture house in Paris to protest Dior’s return to restrictive apparel for women. She designed loosely fitted, box-shaped cardigan-style suits, which became very popular (Figure 2). All of these designs remain influential today, and are very different examples of fit and style.

According to an article in the *Nottingham Evening Post* (2003, p. 1), “What makes a great outfit is the cut. If it fits you, you will be fine.” The article went on to stress how troublesome it was for tall or short women to find apparel that fits them. Tall women cannot find apparel with appropriate lengths and petite women cannot locate shortened and proportionately fitted trousers.

In order to acquire good fit, there must be agreement between several stakeholders: the apparel designer, the patternmaker/grader, and the consumer. Each has different roles in the design process. The designer creates a particular aesthetic look taking into account its relationship to the body. The patternmaker/grader is responsible for the maintenance of the desired look on a variety of body types using few quantities of sizes (Ashdown, 2003).

Several studies on fit have been conducted in other size categories, especially on mature women. For instance, Shim and Bickle (1993), studied and ranked fit satisfaction of apparel purchased from a catalog by women aged 55 years or older subdivided into three categories (petite, medium, and tall). Results showed that “petite consumers were least satisfied with numerous sites of apparel fit,” (Shim and Bickle 1993, p. 61). The dissatisfaction of fit was most apparent in petite women with regard to skirt, dress, and pants leg length, pants leg fullness, crotch length, and jacket length. However, the data collected by Shim and Bickle (1993) were

subjective in that actual measurements were not taken. Instead, subjects provided opinion on fit from apparel purchased from catalogs and on the internet.

In 1996, Goldsberry, Shim, and Reich, conducted a study to establish the first large-scale body dimension database for women age 55 and over. The study compared measurements from a new database and the voluntary product standard PS 42-70 database using an Ultra Fit body suit created for measuring enhancement. In addition, a custom-designed Garment Size Sorting Program GSSP (FORTAN F77) was created to classify subjects into size and figure type categories and determine mean differences between the measurements of the subjects and the standard using t-tests of each. Results indicated that the majority of body measurements including abdominal-extension, waist, sitting-spread, armscye, bust-height (level), back-width, chest-width, hip, and hip-arc, were significantly larger than the PS 42-70 database across the sizes and figure types. These physical dimensional differences were most significant in the Miss Petite size category, range 14 to 18 (Institute for Standards Research, 1993).

In another study, Campbell and Horne (2001) compared women's trousers created from the ASTM D5586 and Canada Standard Sizing (CSS). At the time of the creation of the voluntary product standard PS 42-70, only two percent of the sample included women aged 65 or older. Therefore, it failed to utilize measurements from mature women in creating the size standards. ASTM D5586 was then created in 1994, as a set of standard body dimensions for females aged 55 and older, specifically designed to optimize fit of ready-to-wear garments. The ASTM D5586 measurements were significantly larger in circumference of the waist, abdomen, hip, upper arm, and upper back, than those of the Voluntary product standard PS 42-70 (U. S. Department of Commerce, 1971), but the bust was smaller in comparison. Similar to the PS 42-70, CSS was not representative of body dimensions of mature women.

Campbell, et al (2001) applied Swan and Combs' (1976) theory to determine consumer satisfaction of the ASTM D5586 (size MP16) and CSS (size M18) trouser prototypes based on two factors, instrumental performance and expressive performance. "Instrumental performance refers to the consumer's reaction to the physical aspects of the product, while expressive performance refers to the consumer's emotional response to the product" (Swan and Combs, 1976, p. 26). The most significant variation between the trousers was the waist-to-hip dimension that reflected a discrepancy of 2.1 inches, wherein the ASTM trousers were shorter than the CSS trousers.

The results in Campbell, et al., (2001) showed that while waist measurements for ASTM MP16 and CSS M18 were nearly identical to the statistical mean for the sample, it was not the most important measurement. Participants were more positive about the ASTM trouser than the CSS trouser, indicating that since the ASTM trouser was closer to the mean in the hip and height categories, and it was this measurement that was most valuable in predicting satisfaction with trouser fit. Additionally, the fit of the ASTM trouser was preferred to the CSS trouser in the areas of waist, hip, seat, and crotch length, while abdomen and upper leg comfort were similar for both prototypes (Campbell and Horne 2001, p. 187). This demonstrated that the newer standards developed in the ASTM D5586 study for mature women, offered better apparel fit for mature petite women than that of the CSS and the PS42-70 sizing standards.

Proper fit has the appearance of comfort and is naturally proportionate to the figure, with appropriate amounts of ease for the achievement of a given fashion or garment style (Amaden-Crawford, 1996). "Fit is worse both when the garment is too big and when the garment is too small along a particular dimension," (Ashdown 1998, p. 4). It is possible to rate fit for correctness using a scientific method. For instance, Lai (2002, p. 45), evaluated a narrow skirt that resulted in the creation of a mathematical model capable of predicting comfort and

movement levels of fabric mechanical properties. A correlation coefficient between the predicted and practical values was calculated, and the mean value of residual absolute was 0.3. Therefore, the numbers demonstrated the predictability of the model. However, the fabric mechanical properties are not the sole factor affecting ease and the resulting fit. “The amount of ease needed in a garment will vary by personal preference, the type of fabric used, and the design of the garment. Less ease is required for knitted fabrics than for woven fabrics (Brackelsberg and Marshall, 1994, p.13). Although Lai’s study (2002) demonstrated and supported the ability to rate fit, the study focused solely on the mechanical properties of the fabric used.

The first consideration of fit is ease. Ease may be checked for correctness, excess, or lack of ease. Correct amounts of ease allow for the following: “ $\frac{1}{2}$ inch pick up ease at the side seam/armhole intersection; $\frac{1}{8}$ to $\frac{1}{4}$ inch ease across the front chest area without pulling the front armhole; $\frac{1}{8}$ to $\frac{1}{4}$ inch ease across the back shoulder blade level without pulling the back armhole; $\frac{1}{4}$ inch ease at each quarter of the waist; draped side seams align with the dress form side seam; and side seams drape together without pulling, twisting, or distorting,” (Amaden-Crawford 1996, p. 47).

Incorrect amounts of ease may be evaluated by visually checking for excess ease or lack of ease. Excess ease results in long shoulder seams, folds or gapping across the chest, into the neckline, or at the armhole. On the contrary, lack of ease results in pulling or tightness across the bust, shoulder blade level or waistline, as well as, pulling or twisting of the side seams (Amaden-Crawford, 1996).

Another consideration of proper fit is correct balance and proportion. A muslin sew-up can be examined for correct balance and proportion by taking into account specific criteria (Amaden-Crawford, 1996). The construction of a “muslin sample enables the designer to check the fit, balance, and hang of the two pieces as one unit,” (Amaden-Crawford 1996, p. 48). In

Bracklesberg, et. al. (1986), a study was undertaken to compare the differences, if any, between the fit and ease of traditional flat pattern muslins, and muslins made from plots taken using somatography, their chosen experimental method. Their contention was that there was no statistical difference in the two methods. The results suggested, “that models with flatter body angles obtained a successful fit more often from the *experimental method*. However, models with the deepest body angles were more satisfactorily fitted by the *traditional method*,” (Bracklesberg, et. al. 1986, p. 40). While this information is helpful in determining the best method of fit for different body types, it was somewhat limited in that only six test subjects and one training model were used. This was only a small cross-section of the overall population and therefore limits generalizability.

“Anthropometric data and apparel sizing is an important component of apparel quality. Apparel can not be top quality unless it fits the potential wearers satisfactorily,” (Lee 1994, p. 1). During an interview for Fortune magazine, fashion designer Isaac Mizrahi, in the role of personal shopper (Tyrangiel 2001, p. 2), stated, “It doesn’t matter how good something looks if it doesn’t fit you. Take it off.” He went on to explain the importance of fit and said that consumers associated expensive garments with fit, however, the garments may still require alterations.

The majority of the fit studies conducted concentrated on women age 55 and older (Shim and Bickle, 1993; Goldsberry, Shim, and Reich, 1996; Campbell and Horne, 2001). However, the results demonstrated that mature petite women had the most problems with fit. Research of fit and body type variations yielded methods for ranking the correctness of fit of muslin samples by checking ease, balance and proportion. In addition, Brackelsberg, et al, (1986) found that different patternmaking methods were more suitable for the fit of particular body types.

Sizing

With respect to sizing, the apparel industry has been inconsistent. In some cases, consumers are manipulated by the gradually increasing measurements that constitute sizing systems (Arthur, 2003). For instance, some designers have intentionally increased pattern dimensions, and not the numerical size of the garment, to make consumers believe they are smaller. A study regarding fit in women's pants evaluated size variances between two different labels and price points. Descriptive and inferential statistics showed that the higher the price, the larger the actual size of pants (Kinley, 2003). In the 1980s Liz Claiborne began her business with this type of vanity sizing. Given her overnight success, Levi Strauss and Co. tagged along shortly thereafter, by increasing the waistlines of Dockers half an inch (Arthur, 2003). These practices seemed to make the consumer more brand loyal. The result however, was a large variation in actual dimensions in garments. Therefore, a size 6 in one brand can be a 2 or even a 10 in another brand, thus rendering the numerical values assigned meaningless because they are illogical (Ashdown, 2003).

Further complicating the matter was a possibility of 55 categories of sizing within the domestic women's apparel industry. "No other consumer market in the world has such a diverse population," (Arthur 2003, p. 2). In addition, a demographic shift has divided the two largest demographic groups into baby boomers aged 40 to 50 and teens. The result has been a demand for both larger sizes for older consumers and smaller sizes for the younger ones. "The old bell curve, where the bulk of the demand was in the center of the size continuum, is flattening out rapidly," (Hisey 2003, p. 1). Retailers have to stock sizes 14 and 16 because they have become regular sizes even in the petite category. Even if it were possible to create a sizing standard, it would only account for 20% of the population (Arthur, 2003).

Although the government attempted to standardize sizing, “it didn’t work,” (Arthur 2003, p. 1). This was primarily due to a voluntary sizing system. For instance, Myrna Garner, a sizing expert, co-author, and retired professor of apparel design and merchandising, sat on a national committee for 11 years to revise sizing standards. Although they finally revised the misses’ sizes category, it was also voluntary. Therefore any size can still be labeled as a size 8 (Arthur, 2003). As a result, most domestic designers create their own sizing system based on their fit model, which represents the body proportion of their given target market, and grade it accordingly (Ashdown, 2003).

Another failure in the current sizing systems is a dependence upon outdated anthropometric data collected in the 1920’s to create the Voluntary product standard PS 42-70 in the 1930s (U. S. Department of Commerce, 1971).

Other existing shortcomings in the sizing systems include: inconsistent labeling of sizes; absence of measurements on hangtags (used in Europe); and inadequate size ranges for current body type variations (Ashdown, 1998; Ashdown, 2003). Consumers should ignore size labeling and try on lots of sizes to overcome variations, keeping in mind that as apparel becomes less expensive the actual dimensions of the garment are smaller (Tyrangiel, 2001). “The effectiveness of a sizing system depends on the skill of individual patternmakers and graders and the amount of effort a company puts into defining and producing the type of fit appropriate for its own target market,” (Ashdown 2003, p. 3)

Despite the large percentage of petite women between the ages of 20 and 49 in the U. S. population, the sector has been largely overlooked. With the Latino and Asian population increasing throughout the country, smaller sizes are needed. At the same time, “average sizes...are on the decline, leading to the flattening of the demand curve,” (Hisey, 2003, p. 1).

According to Ashdown (1998, p. 1),

“It is possible to design sizing systems that will accommodate this variability today, given the power and sophistication of computer based calculations. A method of creating optimized sizing systems directly from the anthropometric database is used to create a series of different sizing systems. These sizing systems are designed to optimize the fit using as many variables (body dimensions) as are needed to account for the variability in the population. Therefore the resulting sizing systems will potentially fit the population better than sizing systems based on one or two dimensions only.”

An optimal sizing system selects size groupings that will fit the majority of the population in a limited range of sizes. “Three multidimensional sizing systems” were created using nonlinear optimization methods and U.S. Army anthropometric data to determine “the best fitting sizing system for the population and the best structure of the sizing system,” (Ashdown 1998, p. 1).

In the Ashdown (1998) study, three optimized sizing systems were cross-checked with the most recent industry standard, the ASTM D5585-94, devised as a new voluntary sizing standard for the Misses size category. ASTM D5585-94 uses 39 body measurements and ranges from a size 2 (bust measurement of 32”) to a size 20 (44.5” bust measurement). None of the sizes are based on anthropometric studies. Instead, they depend upon current commonalities found by domestic manufacturers and retailers. The ASTM D5585-94 results were cross-checked with US Army (ANSUR study) and US Navy anthropometric databases. A comparison of D5585-94 and ANSUR revealed more similarities in the measurements of the lower body than that of the upper body. Therefore, optimization systems relied on the circumference of four lower body dimensions to determine the best fit for the garment style of women’s slacks or jeans: hip, waist, crotch height, and crotch length. It was also revealed that ASTM D5585-94 hip sizes were all 10.5” larger than that of the waist.

“None of the sizing standards actually define a method for identifying the misses population. The dimensions commonly used by the apparel industry to identify this population are height and the bust to waist or waist to hip proportion,” (Ashdown 1998, p. 3). Optimization methodology utilizes mathematical equations to determine “the goodness of fit” experienced by an individual in a given size (Ashdown 1998, p. 3; and McCulloch, et al, 1998). Garment fit is formulated by the distance between the individual body dimensions both in the sample and prototype to determine discrepancies and assign an ideal size. The worse the fit, the larger the discrepancy in distance. Advantages of the optimization system include simultaneous identification of individuals matching the prototype body sizes, as well as appropriate size assignment. McCulloch, et al (1998) provide instructions for application of calculations of optimized sizing systems using nonlinear optimization techniques.

Comparison of sizing systems can be conducted using aggregate loss, the measured discrepancies from the assigned size of the entire population. This optimal sizing system reduces aggregate loss and provides the best fit for the average population. Results of the study show that aggregate loss indicated that optimized systems outperformed the ASTM system because the ASTM system does not align on the plot with the densest population allocation. This was probably because ASTM D5585-94 was based on untested industry standards as opposed to anthropometric data from the population using the four key dimensions (Ashdown, 1998).

The grading of an optimized system is different than that of the traditional method because the patterns generated can be stacked, nested and checked for errors without lines crossing each other. The optimized system lacks a relationship between pattern perimeters for each size, since the patterns are dependant upon body proportions between size changes and may contain intersecting lines. This would make it tedious to produce a nest by hand. However,

CAD systems can be programmed to store and calculate these grade rules to generate the patterns (Ashdown, 1998).

Each size in the optimized system changes in proportion to the figure instead of being one size smaller or larger of a given size, so the consumer would not necessarily fit in the next incremental size. Consequently, it would take more fittings for the consumer to obtain the proper size (Ashdown, 1998). The optimized sizing system offers a more even size distribution throughout the range of sizes, and a more accurate anthropometric database of the population increasing the ability to predict sizes of future stock. The body-dimension based system could also be used to categorize population segments, based on age or location, etc. for the purpose of designing for the given target markets (Ashdown, 1998).

According to Holzman (1997), Ashdown and Paal created a database of over 100 dimensions from nearly 3,000 women in the U.S. Army in the late 1980s. They used the data to develop a methodology using cluster analysis via a computer algorithm (Holzman, 1997) capable of deriving a sizing system that provides the best fit for the largest quantity of today's women.

The Army decided to postpone implementation of the use of the method to some time in the future (Holzman, 1997). In the meantime, many other businesses were interested in the technology. If it succeeded commercially, the sizing systems would change from ruler based to population morphology, which would be ever changing with unpredictable transitions between sizes. In addition, the sizes could be market based creating a different range in each apparel category.

Using Ashdown's Sizing System Model (2003, pp. 1-2), it was possible to determine the effectiveness of sizing systems based on four contributing variables: "population measures used as the basis; fit issues related to the wearer, designer, and producer; design features related to

style, materials, and functions; and communication of sizes and fit by the apparel producer to the consumer,” (Ashdown 2003, p. 2).

Studies of sizing systems indicated inconsistencies ranging from deceitful size manipulation, where some manufacturers steadily increased dimensions without changing size labels, resulting in vanity sizing. Some consumers refused to purchase sizes other than those desired (Arthur, 2003). Voluntary sizing systems compounded the problems because without mandatory standards in place, designers created sizing systems based on target markets, thus, rendering the numbering system meaningless. In addition, there were insufficient sizing categories (Ashdown, 2003).

With a growing population of Latino and Asian women, petite apparel demands continue to increase (Hisey, 2003). In addition, the domestic market continues to have the most diverse population (Arthur, 2003). It is important to consider sizing as a factor that contributes to the fit of apparel. It is apparent that problematic sizing systems contribute to lack of fit in apparel. However, it was not the purpose of this study to resolve this issue.

Anthropometric Studies

Anthropometry is defined as “the measurement of the human body with a view to determine its average dimensions, and the proportion of its parts, at different ages and in different races or classes,” (Oxford English Dictionary, 1989. pp. 1-2). According to Lee (1994, p. 1), “In the United States, current sizing standards rely on body measurement data that were gathered by the U.S. Department of Agriculture during the late 1930’s. Apparel must fit today’s population. Except for the study by the American Society for Testing and Materials to improve sizing for women over age 55, there has been no comprehensive anthropometric study of today’s diverse population undertaken in the United States.” The only exceptions are ongoing military studies and two current key statistical gathering studies, SizeUSA sponsored by TCTC and The

Caesar studies (Civilian American and European Surface Anthropometry Resource Project). Although both collected body scans from 14,500 U.S. men and women, as well as 2,500 European men and women, the results were privately funded by company supporters and were not publicly released (Ashdown, 2003). However, TCTC participants in the University of Missouri study of 10,001 scans (both men and women) indicated most women were pear-shaped. As a result, pattern alterations for fit of the pear-shaped population were made with possible modified garments in stores this fall (One size fits few, 2004).

Measurements from the population can provide proportional differences called “variation” and array of sizes known as “range” (Ashdown 2003, p. 2). However, anthropometric studies are expensive to conduct and have been limited. Therefore, representative samples of the entire domestic population have not been taken. This would require crucial factors of age, ethnicity, and body type. Ashdown (2003) believes that “recent technologies such as 3d body scanning and automated measurement have made collection of population data more affordable and available for apparel consumers” (Ashdown 2003, p. 2).

Cornell University apparel design and textile researchers are using revolutionary body scanning technology to improve the domestic apparel industry. A team of researchers studied three-dimensionally scanned data to create patterns that fit consumers better, thus reducing costly returns due to ill-fitting garments (Winter, 2003).

The University of Minnesota has created a Human Dimensioning Laboratory (HDL), a uniquely conceptual educational facility for the incorporated use of apparel designers, kinesiologists, and engineers. It is the first lab in the world that utilizes three-dimensional body scanning and sewing machines to perform complex motion analysis in order to improve the design, safety, and performance of clothing, sports gear, orthotic and prosthetic products, as well as lifesaving medical devices. Implications of the research include increasing the

competitiveness of the domestic apparel industry and making the cost of customization comparable to that of mass-produced products (Tyler 2004, Spring).

Data for the research were collected from a cross-section of subjects, as the primary move toward “mass customization” and the creation of appropriate sizing systems and apparel fit. Aesthetic factors will be difficult to address because of the varied social and psychological factors influencing customer satisfaction with comfort and personal taste. The researchers hope to collect and use subject preferences for the development of customization models (Tyler 2004, Spring).

In 1983, Patterson and Warden found that, “no single body measurement provided an adequate base for a sizing system because no single dimension was highly correlated with both the horizontal and vertical measurements” (Patterson and Warden 1983-84, p. 27) However, “based on the statistical analysis, weight and height were found to be the best overall indicators of horizontal and vertical body measurements” (Patterson and Warden 1983-84, p. 27). Because women’s sizing systems are not printed on apparel labels and lack a correlation to body dimensions, manufacturers are able to create their own sizing systems. Present sizing systems assume an association between height and width, and do not incorporate the vast variation of figure types or body proportions in the population. In reality there is no such relationship (Holzman, 1997).

“Throughout the 20th century, Americans got progressively larger and larger,” (Hisey 2003, p. 1). The pace has increased over the past 10 years. Businesses have had to answer quickly to meet the evolving market. Factors contributing to the change in population size include: advances in medicine, changes in eating habits, and increased sedentary lifestyles.

In a study undertaken to create a proposed apparel sizing system, fifty women’s apparel manufacturers and suppliers to Neiman Marcus, were surveyed regarding dimensions of the ideal

misses size eight. The data collected included bust, waist, and hip measurements from the sixteen manufacturers that responded to the survey. Results indicated vast variances of dimensions from manufacturer to manufacturer as well as a similar disparity between the bust and waist, bust and hips, and hips and waist dimensions. In addition, the survey demonstrated that the dimensions were much larger than those set by the Voluntary product standard PS 42-70 (Tamburrino, 1992c).

Tamburrino (1992a, 1992b) performed two other studies regarding apparel sizing. The first dealt primarily with circumferential and longitudinal dimensions. The results showed that “the circumferential dimension is the girth of the most critical point needed to fit the garment. The most important circumferential dimension of the body, depending on the type of garment and the country, is one of the following girths: neck, chest/bust, waist or hips. Similarly, the longitudinal dimension is the most important length measurement needed for fit, i.e., waistline, arms, legs, pelvis” (Tamburrino, 1992a, p. 45). However, only a small percentage of the population actually fell into predetermined sized categories.

Tamburrino (1992b) also discussed the varying body proportions of different ethnic groups, and the lack of current statistics due to the absence of actual dimension allocation to the size designations and resulting unreliability of standardization. The study also demonstrated the impact of posture and its affect on proper patternmaking techniques for the custom tailoring process. Tamburrino (1992b) concluded that there was “a significant variance among ethnic groups.”

The increased population of Latinos, which is second only to Caucasians, and the rising numbers of Asians, has created an enlarged demand for petite sized apparel because these ethnic groups tend to be much smaller in stature than Caucasians and African-Americans (Hisey, 2003). At present, 47 percent of the women in the United States are petite (less than five feet four inches

tall) (U. S. Department of Commerce, 2000). Misses' petite sizes are $\frac{3}{4}$ - 1 inch shorter between the back neck and waistline and $\frac{1}{2}$ - 1 inch shorter between the waistline and hipline than the measurements provided by the misses' pattern (Standardized Pattern Measurement Chart for Women, Brackelsberg and Marshall, 1994; U. S. Department of Commerce, 1971).

A study with 223 respondents revealed that American women were increasing in size and becoming more pear-shaped. The participants ranged from ages 20-29, were 92% Caucasian, 51% self-reported hourglass body type, weighed approximately 130.81 pounds, were 64.01 inches tall, with an average bust circumference of 35.08 inches, average waist circumference of 27.09 inches, and hip circumference of 36.09 inches (Alexander, 2000). In addition, respondents reported approximately 50% dissatisfaction with fit at the bust, waist, hip, dress length, and pant length (Alexander 2000, p. 162) indicating a significant ready-to-wear fit problem.

Some anthropometric studies involving mature women have been conducted, as well. Lang (1994) found that apparel was not designed for older women who experience changes in stature such as forward angle of the head and neck, forward shoulder roll, back curvature, increased girth, and decreased height. Ashdown and Kohn (1996) conducted one of the only studies on postural changes in older women and its affect on fit. They created a "nylon taffeta jacket with standardized slashes that pinpoint where the garment's stresses are when worn. Slashes were cut in vertical, horizontal, and diagonal directions to the grain" (Lang 1996, p. 2). Subjects between ages 55 and 65 were videotaped in the workplace in both a slashed and unslashed jacket. Subjects answered questionnaires, a panel of experts evaluated the fit, and the video was computer analyzed. The pilot study was set to be conducted on a larger scale (Lang, 1996).

Hebert (1994) also analyzed the fit of apparel on mature women and provided improved patternmaking applications for improvement of fit. She also concluded that modifications to

commercial patterns could yield specialization of sizes. However, no studies have focused solely on petite women and their body type variations for women under the age of 55.

It has been shown that the compilation and comparison of body measurements can be beneficial. Lee (1994) compared five body measurements to configure body dimensions for the manufacture and fit of apparel. The comparison also provided the basis for the development of a data model for made-to-measure pattern making. Two glossaries were compiled; the first consisted of body landmarks used in defining body dimensions, while the second included all of the human body dimensions (totaling ninety-one) utilized in pattern and garment making. The dimensions were subdivided into five fields: numeric identification, dimension name, definition, category, and references. The body dimension information will serve as the foundation for the “development of the information model of made-to-measure pattern making” (Lee 1994, p. 4). The results “will contribute to future body measurements surveys as well as the development of new or improved sizing standards” (Lee 1994, p. 5). Anthropometric studies have been limited

primarily due to expense. Therefore, the industry sizing standards in place are based on outdated anthropometric data from the 1930s (Lee, 1994; U.S. Dept. of Commerce, 2000).

The U.S. apparel industry produces apparel that does not fit the body proportions of the contemporary female consumer. This was due both to a sizing system based on outdated anthropometric data from the Voluntary product standard for Misses Petite – Voluntary product



Figure 3 – Typical Dress of 1920 -1930s
USDA Miscellaneous Publication 454, 1951

standard PS 42-70 created in the 1930s, and a rising obesity problem. In 2000, the US Dept. of Commerce reported 47% of women are petite and about 65% of U.S. women are either overweight or obese (U. S. Department of Commerce, 2000), resulting in an array of figure type variations ranging from apple-shaped to pear-shaped women, as opposed to the typical hourglass shape (Figures 3 & 4).

The Alexander (2000) study found that consistent with previous literature, U.S. women are getting larger and more pear-shaped. The apparel industry does not provide adequate attention to figure type variations throughout the misses' petite sector. Recently, body-scanning equipment facilitated anthropometric studies across the US. Simmons (One size fits few, 2004), University of Missouri professor, in partnership with the SizeUSA study (2003), found similar results after scanning 10,001 men and women. The study was privately undertaken in conjunction with a limited number of manufacturers. As a result, the data collected, and the body dimensions, are restricted from public access. However, Simmons (2004) confirmed earlier findings that the women had larger hip circumference measurements than bust circumference measurements, resulting in pear-shaped women as opposed to hourglass. Limited accommodations in apparel manufacturing are presently being made for the changes in body dimensions.



Figure 4 – Hourglass Silhouette
Seeling 1999, p. 3.

Summary

Studies on apparel fit and figure type variation for the petite sector are very limited, and primarily focused on the mature age group aged 55 and older. Although a significant fit problem with petite garments exists, little resolution has occurred. With the exception of a few studies, there has been no significant research done in this area. Sizing is voluntary, lacks uniformity, utilizes meaningless labeling, and there is an inadequate size range to accommodate present figure type variations. It is further complicated by vanity sizing and psychological factors.

Body dimensions of women have evolved since the original anthropometric study in the 1930s. In addition, body dimensions of women have changed drastically within the past decade, with a rising obesity factor, as well as an increasing ethnic population with different figure types. As a result, previous anthropometric industry standards are no longer representative of the current population and are therefore nearly obsolete. Some exception lies in the SizeUSA study privately conducted using body-scanning technology. However, the data are not readily accessible to the public and are owned by the companies that funded the research making it limited in scope.

Results of the anthropometric studies indicated that there was generally a need for petite sizing and resolution of fit problems, as well as design and aesthetic problems. In addition, specialization in conjunction with technology can be beneficial and vital to the maintenance of any competitive advantage of the domestic apparel industry. At stake is the economic viability of a once thriving industry.

CHAPTER 3

METHODOLOGY

This chapter contains the procedures used for this study and is organized in the following manner: sample, measurements, pattern development, figure type variations, muslin proofs, and fit instrument development.

Sample

The subjects for this study consisted of 52 petite females, five feet four inches or under, and between the ages of 20-49. The non-probability sample was taken from a metropolitan area in the southeastern United States.

Measurements

Most of the studies evaluating fit have used a variety of approaches. Some measured the discrepancies between body dimension and the sample garment, while others focused on body dimensions and industry standards. In addition, a majority of the studies focused on mature women over the age of 55. However, in this study the distance between the body dimension and the sample garment was established using minimal amounts of ease based on Brackelsberg and Marshall (1994).

Measurements were collected systematically, holding the measuring tape snug without being tight and with fingers held on the outside of the tape, away from the area being measured. Each dimension measured was taken and recorded (Brackelsberg and Marshall 1994, pp. 14-17):

- Bust - full bust circumferential measurement taken over the fullest part of the bust with the measuring tape parallel to the floor.
- Waist – natural waistline circumference occurring at the narrowest part of the trunk between the bust and hipline with the measuring tape parallel to the floor.
- Hips – circumferential measurement of the fullest part of the hipline across the seat and parallel to the floor.
- Neck to Waist – vertical length from the base of the back neckline (the top most prominent vertebra) to the waist.
- Waist to Hips – vertical length from the waist to the hips.

Pattern Development

Using proprietary measurement data, the mean, median, mode, and frequency distribution of the data were determined to formulate the measurements and develop the petite pattern representative of the sample. The distance between the body dimension and the sample garment was established by adding only the minimal amounts of ease (Amaden-Crawford 1996, p. 47; Brackelsberg and Marshall 1994, p. 14).

An industry pattern with body measurements based on the Misses Petite (Table1) voluntary product standard PS 42-70, Body Measurements for the Sizing of Women's Patterns and Apparel (U. S. Department of Commerce, 1971, p. 9) was drafted, and included a basic bodice, skirt, and sleeve using the standard measurement chart and the procedure outlined in Armstrong (2006, pp. 30-60).

Table 1 - Misses Petite

Size	8P	10P	12P	14P	16P	18P
Bust Circumference	32 ½	33 ½	35	36 ½	38	40
Waist Circumference	23 ½	24 ½	26	27 ½	29	31
Hip Circumference	34 ½	35 ½	37	38 ½	40	42
Waist Length, back (Neck to Waist Length)	14 ¼	14 ½	14 ¾	15	15 ¼	15 ½
Waist to Hip Length	7 ½	7 ¾	8	8 ¼	8 ½	8 ¾
Height	59 ½	60	60 ½	61	61 ½	62

(Voluntary product standard PS 42-70, U. S. Department of Commerce 1971, p. 9)

Using an industry pattern developed from the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60) with body measurements most similar to the voluntary product standard PS 42-70, size Misses Petite 16 (P16), it was modified to represent the measurements of

the voluntary product standard PS 42-70, size Misses Petite 16. The following techniques were employed:

A. Bodice – Alteration for shortened bodice length (Brackelsberg and Marshall 1994, p. 40).

- On bodice back, 1" above waistline, from center back seam to side seam (a to b), drew an even horizontal line.
- On bodice back, 3 $\frac{3}{4}$ " above waistline, from center back seam to side seam (a to b), drew an even horizontal line, leaving a space between the horizontal lines at the center back seam, equivalent to 2 $\frac{3}{4}$ ". Lapped out the space between the horizontal lines, 2 $\frac{3}{4}$ ".
- Redrew the center back seam between a and the center back seam/waistline intersection, and redrew the side seam between b and the side seam/waistline intersection.
- Redrew the dart legs from the original apex to the original waistline placement.
- On bodice front, 1" above waistline, from side seam to center front seam (a to b), drew an even horizontal line.
- On bodice front, 3 $\frac{3}{4}$ " above waistline, from side seam to center front seam (a to b), drew an even horizontal line, leaving a space between the horizontal lines at the center front seam, equivalent to 2 $\frac{3}{4}$ ". Lapped out the space between the horizontal lines, 2 $\frac{3}{4}$ ".
- Redrew the dart legs from the original apex to the original waistline placement.

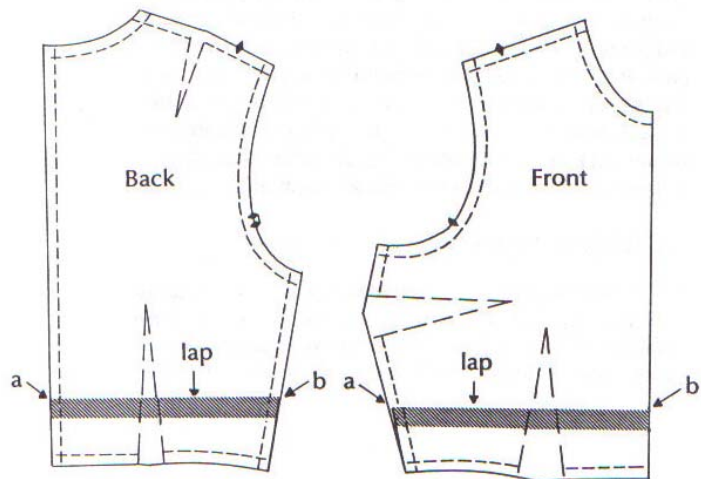


Figure 5 - Shorten bodice an even amount. Brackelsberg and Marshall 1994, p. 40.

B. Bodice – Alteration for decreased front and back shoulder width (Brackelsberg and Marshall 1994, p. 31).

- Drew a perpendicular line to center front (from b to c) across the chest to the armhole, 1" above the front armhole notch.

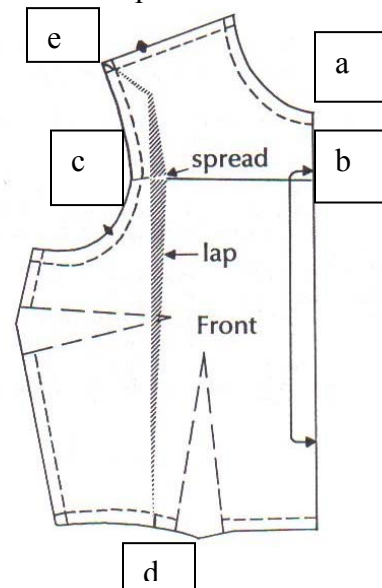


Figure 6 – Decreasing front bodice chest width. Brackelsberg and Marshall 1994, p. 31.

- Drew a line parallel to center front, 1 ½" in from the armhole, beginning at the waistline (d) and ending 2" below the shoulder. At the top of the line, angled the end to the shoulder/armhole intersection (e).
- Slashed open the line from d to e. Also slashed open from line d to point c along the b to c line.
- Cut the seam allowance to points c and e, so pattern laid flat.
- Lapped ½ needed amount to decrease bust circumference and narrow upper shoulder.
- Redrew the waistline seam to correct the seam line.
- If necessary, redrew the bust dart on the front bodice pattern piece.
- Repeated procedures on the back bodice for decreased back shoulder width.

C. Bodice – Split bust dart into two equivalent darts (2" spread each), one bust waist dart and one bust side dart (Armstrong 2006, p. 98).

Figure 7

- Drew a square line on paper.
- Placed center front on square line with center front waist touching corner as shown. Secured.
- Closed waist dart until point X touched square line. (Broken line is original pattern.)
- Traced, marked bust point.
- Centered the point of waist dart 1" from bust and side dart 1 ¼" from bust point.
- Redrew dart legs to new dart point.

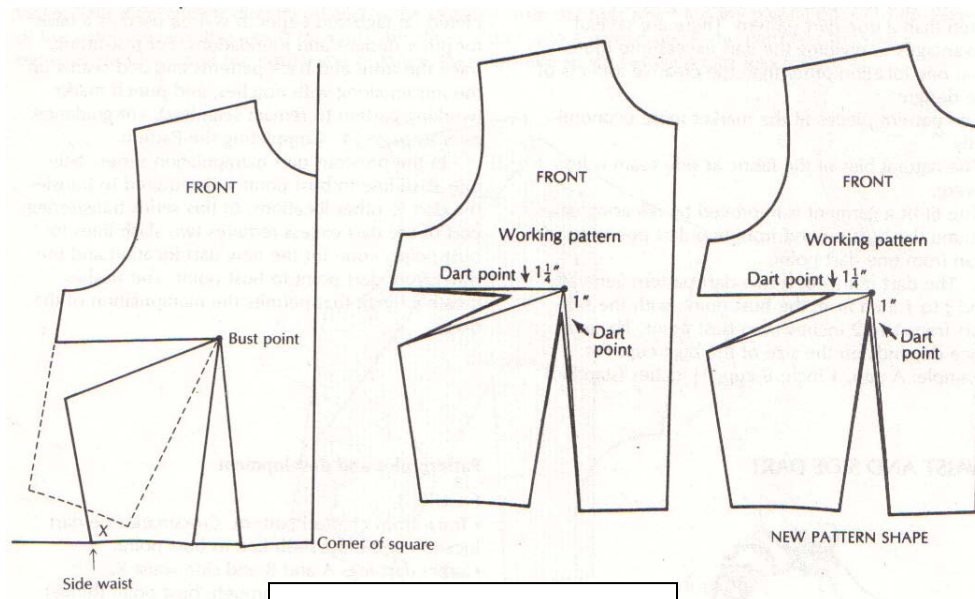


Figure 7 – Split bust darts.
Armstrong 2006, p. 98.

D. Bodice – Decreased chest/bust circumference at side seam (Brackelsberg and Marshall 1994, p. 34).

Bodice Back

- From armhole/side seam intersection, measured in $\frac{1}{4}$ " and labeled point a.
- Drew a line from point a to point b (the side seam/waistline intersection).
- Re-established the $\frac{1}{2}$ " seam allowance along the side seam.

Bodice Front

- Closed bust dart intake from armhole/side seam intersection, measured in $\frac{1}{4}$ " and labeled point a.
- Drew a line from point a to point b (the side seam/waistline intersection).
- Re-established the $\frac{1}{2}$ " seam allowance along the side seam.
- Cut the side seam allowance.
- Opened bust dart intake.
- Redrew dart legs.

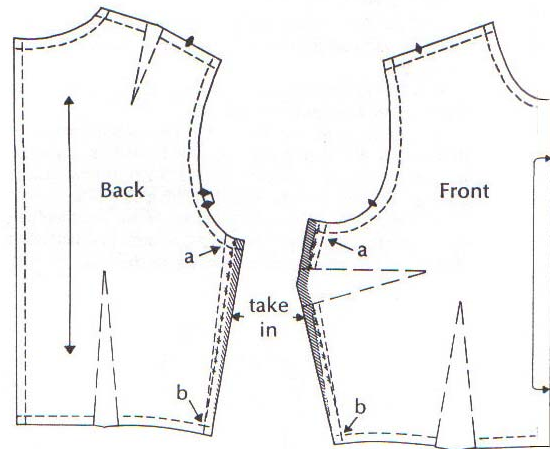


Figure 8 – Decreasing bodice bust circumference. Brackelsberg and Marshall 1994, p. 34.

E. Bodice – Decreased waistline circumference (Brackelsberg and Marshall 1994, p. 47).

- Measured in 2" from the waistline/side seam intersection (c), and labeled new point a. Drew a diagonal line, beginning from the waistline at point a to the armhole/side seam intersection (b).
- Slashed open the line from a to b, and continued through b to c.
- Cut the seam allowance to points a and c, so pattern laid flat.
- Lapped $\frac{3}{8}$ " needed amount to decrease waist circumference.
- Redrew the waistline seam as a smooth curve.

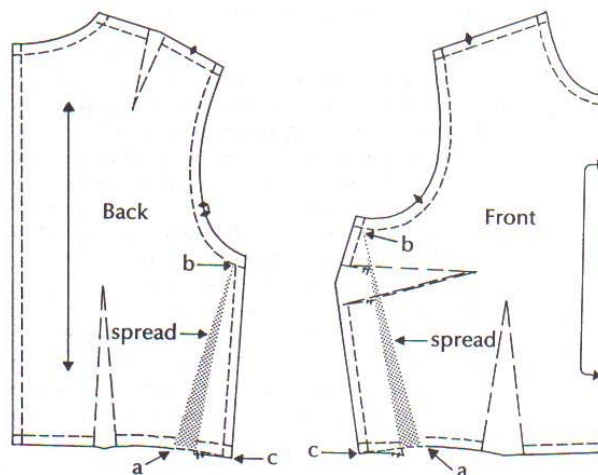


Figure 9 – Decreasing bodice waist circumference. Brackelsberg and Marshall 1994, p. 47.

F. Skirt - Decreased waistline circumference (Brackelsberg and Marshall 1994, p. 47).

- Drew a vertical line, parallel to center front (from a to b), beginning at the waistline and ending 2" above the hipline. At the bottom of the line, extended the line diagonally to the hipline/side seam intersection (c).
- Slashed open the line from a to b, and continued through b to c.
- Cut the seam allowance to points a and c, so pattern laid flat.
- Lapped 3/8" needed amount to decrease waist circumference.
- Redrew the waistline seam as a smooth curve.

G. Skirt – Decreased hipline and thigh circumference

- Began at the waistline/side seam intersection (a), measured down the “waist to hip” measurement and labeled the full hip measurement b.
- Drew a horizontal line from b, perpendicular to center front and the lengthwise grain.
- Drew a vertical line 2" from side seam, parallel to center front and lengthwise grain (from c to d), beginning at the bottom and ending 2" below the waistline. At the top of the line, extended the line diagonally to the waistline/side seam intersection (a).
- Slashed open the line from c to d, and continued through d to a.
- Cut the seam allowance to point a, so pattern laid flat.
- Lapped 3/8" needed amount to decrease waist circumference.
- Redrew the hemline seam with added length and restored original hemline placement.

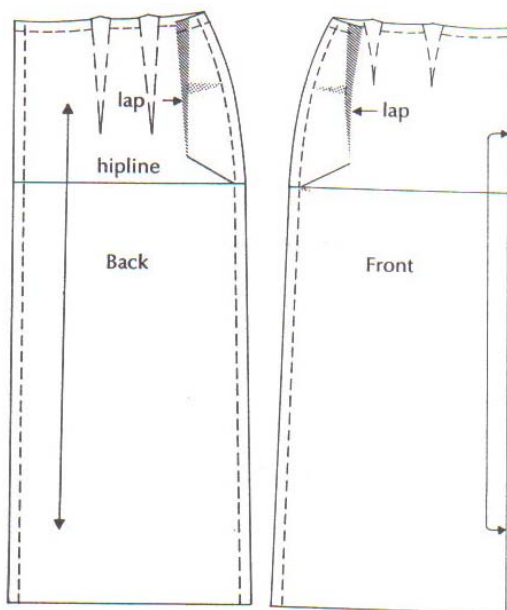


Figure 10 – Decreasing skirt waist circumference.
Brackelsberg and Marshall 1994, p. 47.

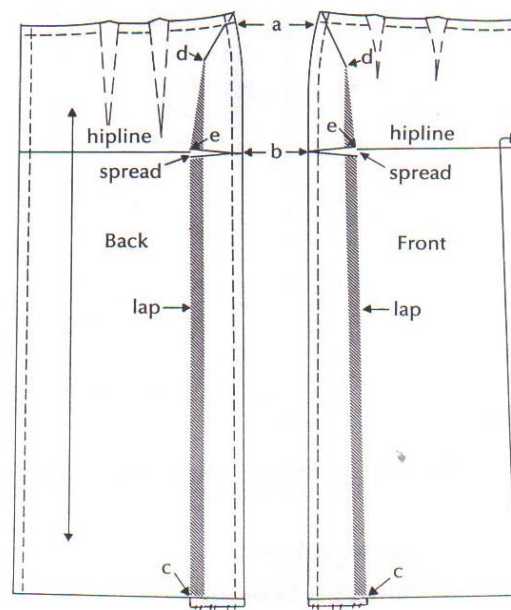


Figure 11 – Decreased hip circumference.
Brackelsberg and Marshall 1994, pp. 45-46.

Using the voluntary product standard PS 42-70, size Misses Petite 16 pattern, an industry pattern developed from the Standard Measurement Chart, size 16 with body measurements most similar to the sample mean, the pattern was modified to create the prototypical petite pattern, size Misses Petite 16. The procedures were repeated for developing the voluntary product standard PS 42-70 with the following measurement adjustments:

Shortened bodice length $\frac{1}{4}$ ".

- Decreased chest width and bust circumference $3 \frac{1}{8}$ ".
- Decreased bodice and skirt waistline circumference 1".
- Decreased hipline circumference $\frac{1}{2}$

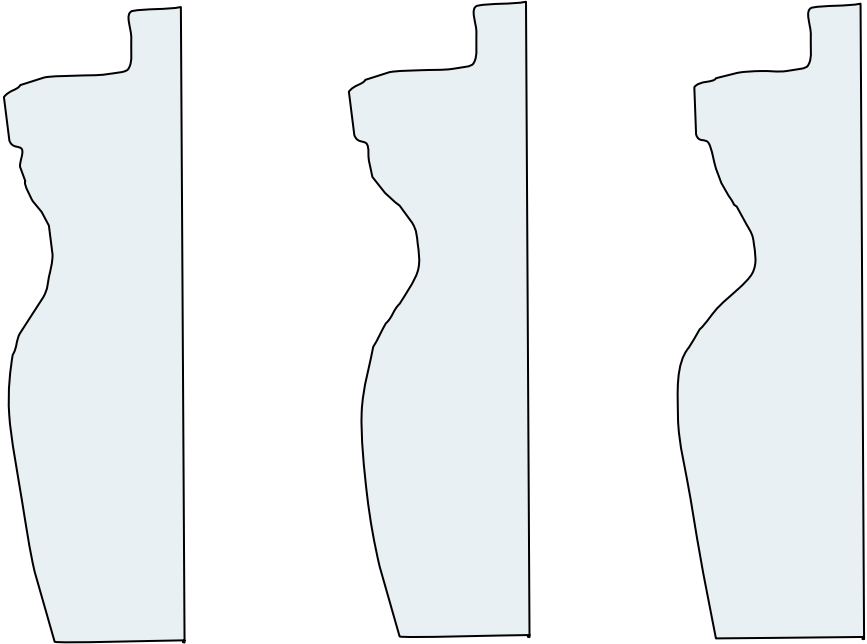
Measurements of the sample mean were compared to the voluntary product standard for Misses Petite (Voluntary product standard PS 42-70, U.S. Department of Commerce, 1971, p. 9), to determine if there were differences. Mean differences between the sample mean and voluntary product standard PS 42-70 were calculated to compare the two patterns.

Figure Type Variations

Using established criteria for apple-shaped and pear-shaped figure type variations the means were calculated for apple-shaped and pear-shaped figure type variations. The figure type of each subject in the sample was determined. The prototypical petite pattern was modified for petite apple-shaped and pear-shaped figure type variations based on the sample. Using statistical results from frequency distributions, the average measurements of both the apple-shaped and pear-shaped figure type variations were determined to establish the measurements of each figure type using the criteria in Table 2 (Armstrong, 1995, p. 37).

The criteria used for calculating the apple-shaped, pear-shaped, and hourglass figure type analysis were in accordance with the definitions in the review of literature. The calculation/syntax for determining the apple-shaped figure type variation was "compute apple = 0. If (abs (bhdiff2 le 2) and (whdiff2 le 8)) apple = 1." The calculation/syntax for determining

Table 2 – Silhouette Definitions and Diagrams

Apple-shaped	Hourglass	Pear-shaped
Shoulders and hips aligned, waist/hip difference is 8 inches or less	Shoulders and hips aligned, waist/hip difference is 13 Inches or more	Shoulders narrower and bust smaller than hourglass; hipline area and upper thigh region is much fuller than that of the hourglass
		

(Armstrong, 1995, p. 37)

the pear-shaped figure type variation was “compute pear = 0. If (bhdiff2 ge 4) pear = 1.” The calculation/syntax for determining the hourglass figure type variation was “compute hourglass = 0. If (abs (bhdiff2 le 2) and (whdiff2 le 13)) hourglass = 1.” Once it was discovered that there were no hourglass-shaped figure type variations in the study and a large portion of the sample remained unrepresented, another calculation, which accounted for the remainder of the sample, was performed. This category was named average. The calculation/syntax for determining the

average figure type variation was “compute average = 0. If ((pear = 0) and (apple = 0) average = 1.”

Using a copy of the prototypical petite pattern, the waist circumference in the bodice and skirt pattern pieces was increased in accordance with the apple-shaped measurements (Brackelsberg and Marshall 1994, p. 30):

A. Bodice – Alteration for increased waistline circumference

- On waistline, 2” in from side seam, diagonally slashed to the armhole/side seam intersection (a to b).
- Cut the seam allowance to point b, so pattern laid flat.
- Spread $\frac{1}{4}$ needed amount to increase waist circumference.
- Redrew the waistline seam between a and c to correct the seam line.
- If necessary, redraw the bust dart on the front bodice pattern piece.

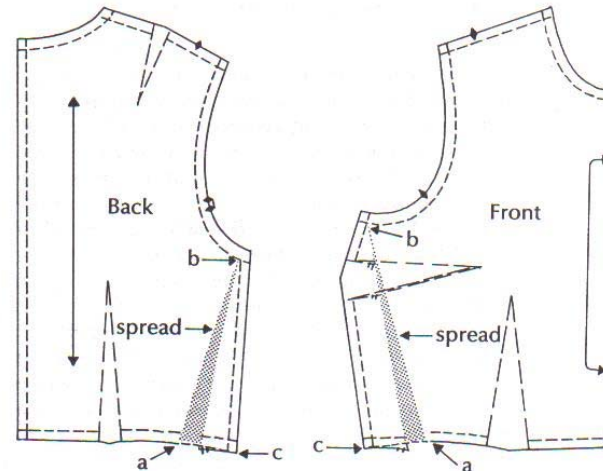


Figure 12 – Increasing bodice waist circumference. Brackelsberg and Marshall 1994, p. 31.

B. Skirt - Alteration for increased waistline circumference

- Drew a vertical line, parallel to center front (from a to b), beginning at the waistline and ending 2” above the hipline. At the bottom of the line, extended the line diagonally to the hipline/side seam intersection (c).
- Slashed open the line from a to b, and continued through b to c.
- Cut the seam allowance to points a and c, so pattern laid flat.
- Spread $\frac{1}{4}$ needed amount to increase waist circumference.
- Redrew the waistline seam as a smooth curve.

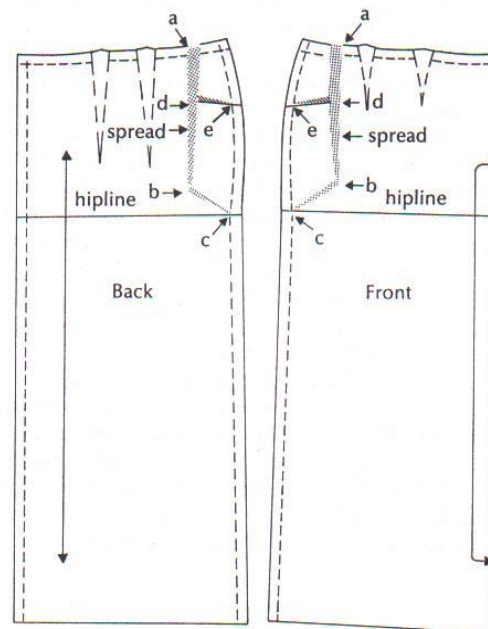


Figure 13 – Increasing skirt waist circumference. Brackelsberg and Marshall 1994, p. 47.

- Option, if high hip alteration was necessary, measure down 3" from waistline along side seam (e), slashed from a to b line to point e and cut seam allowance to point e.

Using a copy of the prototypical petite pattern, the bust circumference was decreased and the hip circumference was increased in accordance with the pear-shaped measurements (Brackelsberg and Marshall 1994, pp.30-31):

A. Bodice – Alteration for narrow chest

- Drew a perpendicular line to center front (from b to c) across the chest to the armhole, 1" above the front armhole notch.
- Drew a line parallel to center front, 1 ½" in from the armhole, beginning at the waistline (d) and ending 2" below the shoulder. At the top of the line, angled the end to the shoulder/armhole intersection (e).
- Slashed open the line from d to e. Also slashed open from line d to point c along the b to c line.
- Cut the seam allowance to points c and e, so pattern laid flat.
- Lapped ½ needed amount to decrease bust circumference and narrow upper shoulder.
- Redrew the waistline seam to correct the seam line.
- If necessary, redrew the bust dart on the front bodice pattern piece.

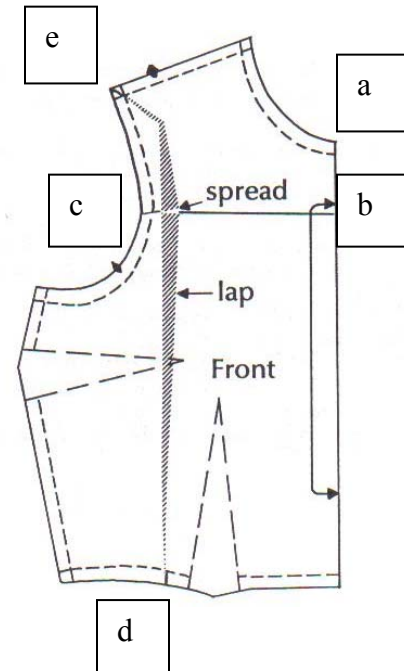


Figure 14 – Decreasing front bodice chest width. Brackelsberg and Marshall 1994, p. 31.

B. Bodice – Alteration for decreased bodice front darts for small bust

- Drew a line extending underarm dart (beginning from bottom dart leg, d) and waistline dart (beginning from center dart leg, b) so they intersected at the bust point (a).
- At the top of the line at the d and b intersection, angled the end to ¼" below the armhole notch, point c.
- Slashed open the line from b to a. Continued slash through a to point c.
- Slashed open line d, to but not through to point a.

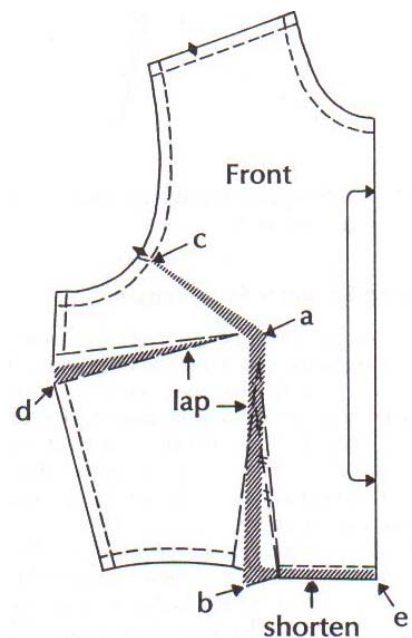


Figure 15 – Decreasing bodice front darts. Brackelsberg and Marshall 1994, p. 33.

- Cut the seam allowance to point c, so pattern laid flat.
- Lapped needed amount to decrease bust darts. Also lapped same amount in vertical slash (a to b) to lap the diagonal slash and bust-fitting dart.
- Located new dart point, 1" from bust point (with two darts).
- Redrew the dart legs, folded and trued dart ends.
- Redrew the waistline seam to correct the seam line.
- Shortened front length usually necessary for small bust.

C. Skirt – Alteration for increased hipline and thigh circumference

- Began at the waistline/side seam intersection (a), measured down the “waist to hip” measurement and labeled the full hip measurement b.
- Drew a horizontal line from point b, perpendicular to center front and the lengthwise grain.
- Drew a vertical line 2" from side seam, parallel to center front and lengthwise grain (from c to d), beginning at the bottom and ending 2" below the waistline. At the top of the line, extended the line diagonally to the waistline/side seam intersection (a).
- Slashed open the line from c to d, and continued through d to a.
- Cut the seam allowance to point a, so pattern laid flat.
- Spread $\frac{1}{4}$ needed amount to increase hip and thigh circumference.
- Redrew the hemline seam with added length and restored original hemline placement.
- Option, if high hip alteration were necessary, slash from c to d line to point b and cut seam allowance to point b.

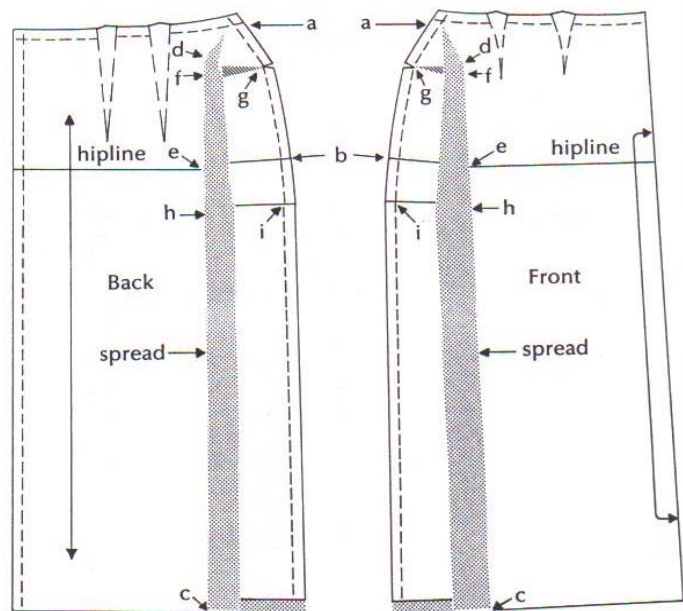


Figure 16 – Increasing skirt hip and thigh circumference. Brackelsberg and Marshall 1994, pp. 45-46.

Muslin Proofs

The development of the muslin proofs of each pattern facilitated the evaluation by the judges and live fit models. Preliminary results of the prototypical petite pattern indicated that there was an error. The error occurred when the prototypical petite pattern development began with the voluntary product standard PS 42-70 pattern for the Misses Petite, size 16P, using the

calculated differences between the sample mean and pattern developed from the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60). As a result, the prototypical petite pattern had discrepancies in the circumferential measurements. Therefore, a corrected prototypical petite pattern was developed upon discovery of the error, from the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60), using the original calculations differences between the sample mean and the pattern from the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60). The corrected prototypical petite pattern was labeled F. Five muslin proofs of the patterns were developed using ½” seam allowances, with all pertinent markings and the following labels:

- Apple-shaped petite pattern – Proof A
- Pear-shaped petite pattern – Proof B
- Prototypical petite pattern based on the sample– Proof C
- Average-shaped petite pattern – Proof D
- Voluntary standard product PS 42-70 petite pattern - Proof E
- Corrected Prototypical petite pattern based on the sample– Proof F

Fit Instrument Development

Fit instrument development of the Judge Fit Evaluation Index (Appendix A) was based on the fit criteria in Amaden-Crawford, (1996, p. 48) and Betzina (2001, pp. 6-7). It was divided into three areas: general principles of fit, appropriate amounts of ease, and proper placement. It was designed to facilitate assessment of the fit of the muslin proofs on the live fit models.

The development of the instrument for the live fit models, Model Fit Evaluation Index (Appendix B) was also based on the fit criteria in Amaden-Crawford, (1996, p. 48) and Betzina (2001, pp. 6-7). It was divided into 4 sections, focused on the fit of the garment and fit satisfaction. These sections included fit of the garment when moving, circumferential fit of the garment, longitudinal fit of the garment, and satisfaction of fit of the garment.

Using the instrument developed by the researcher (Judge Fit Evaluation Index, Appendix A), three professionals with expertise in fit, evaluated the fit of the muslin proofs on the live fit models. Each fit model stood individually in front of the panel of judges as judges responded to the Judge Fit Evaluation Index (Appendix A). Although there were originally 21 questions on the instrument, only 19 were used because one question was duplicated and one called for subjective rather than objective judgment. When each fit model finished modeling for the judges, she completed the Model Fit Evaluation Index (Appendix B), designed to elicit her evaluation of the fit of the garment. Using the instrument developed by the researcher (Model Fit Evaluation Index, Appendix B), four live models evaluated the fit of the muslin proofs. Data gathered from each instrument were statistically analyzed to obtain mean, median, mode, and frequency distributions. Actual means were compared to expected means.

CHAPTER 4

RESULTS AND DISCUSSION

Body measurements were taken from a proprietary sample of petite women to determine if the industry standard of fit was accurate. Patterns and muslin proofs, based on sample and industry measurements, were developed and evaluated for fit. Results of the data analysis are discussed in this chapter, and organized into the following: sample profile and hypothesis testing.

Sample Profile

The subjects for this study consisted of 52 petite females, five feet four inches or under, and between the ages of 20-49. The sample was taken from a metropolitan area in the southeastern part of the United States. It was comprised of a non-probability sample of subjects that purchased custom-designed evening, debutante, and bridal gowns. The subjects had completed high school and the majority had some college education. Of the subjects that had completed college, some were not employed, while others were employed at least part-time. In addition, the majority of the subjects were white, with a small Hispanic minority also represented.

Hypothesis Testing

Hypothesis I

There will be differences in the measurements of the industry standard hourglass and the sample mean.

Supported by the review of literature, the descriptive statistical analysis of the sample measurements (Table 3) resulted in a mean comparable to that of a size 16 petite according to the voluntary product standard PS 42-70, (U.S. Department of Commerce, 1971). The majority of the subjects had a bust circumference that measured 3.05 inches less than that of the hip

circumference, indicating a pear-shaped silhouette consistent with information found in the literature. (Alexander, 2000; Simmons, 2004; & One size fits few, 2004).

Table 3 – Analysis of Sample Measurements (inches)

	Mean	Median	Mode
Bust Circumference	37.38	36.00	36.00
Waist Circumference	30.17	29.00	29.50
Hip Circumference	40.43	39.50	37.50
Waist Length, back (Neck to Waist Length)	14.33	14.50	15.00
Waist to Hip Length	8.53	8.50	9.00
Height	63.97	63.50	62.00

The figure type analysis of the sample of the 52 subjects resulted in a varied distribution of: four apple-shaped, 19 pear-shaped, 28 average-shaped, and no hourglass-shaped figure types (U.S. Department of Commerce, 2000; Tamburrino, 1992c). Of particular interest were the 28

Table 4 – Measurement (inches) Differences Between Sample Mean and Industry Standard Hourglass (Armstrong, 2006).

	Sample Mean	Industry Hourglass Size 16	Difference
Bust Circumference	37.38	40.5	- 3.12
Waist Circumference	30.17	30.5	- 0.33
Hip Circumference	40.43	42.0	- 1.57

body types that failed to fall into any of the three industry definitions and the absence of any hourglass-shaped body type variations. A majority of the sample did not fit industry definitions because they were neither hourglass (with a waist to hip difference of 13 inches or more) nor apple-shaped (with a waist to hip difference of 8 inches or less) nor pear-shaped (with a smaller bust than hourglass with a hipline region much fuller than that of the hourglass), and were put into a category called average. This finding supports the contention that the sample mean of this study, was not accommodated by the voluntary product standard PS 42-70 sizing standards (Campbell and Horne, 2001; Tamburrino, 1992c). In addition, it illustrates a different average of the sample from the silhouette definitions listed in Armstrong (1995).

Table 5 - Sample Figure-type Variation Means

	Apple	Average	Pear
Bust Circumference	40.88	36.27	38.09
Waist Circumference	35.45	28.25	31.62
Hip Circumference	38.43	38.56	43.70
Waist Length, back (Neck to Waist Length)	14.60	14.43	14.11
Waist to Hip Length	7.90	8.63	8.58

Hypothesis II

There will be differences between the measurements of the voluntary product standard PS 42-70 petite pattern and the prototypical petite pattern in the:

- a) bust
- b) waist

- c) hips
- d) back neck to waist
- e) waist to hip

Voluntary product standard PS 42-70 measurements for a size 16 petite, created from the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60), resulted in a benchmark for comparison of the prototypical petite pattern for the sample mean, as well as a starting point for the remaining pattern modification that followed. Differences between sample measurements and voluntary product standard PS 42-70, (U.S. Department of Commerce, 1971) are shown in Table 6.

Table 6 – Measurement (inches) Differences Between Sample and Voluntary Product Standard PS 42-70, (U.S. Department of Commerce, 1971)

	Sample Mean	VPS 42-70 Size 16P	Difference
Bust Circumference	37.38	38.00	- 0.62
Waist Circumference	30.17	29.00	1.17
Hip Circumference	40.43	40.00	0.43
Waist Length, back (Neck to Waist Length)	14.33	15.25	-1.08
Waist to Hip Length	8.53	8.50	0.03
Height	63.97	64.00	-0.03

T-test results (Table 7) comparing the voluntary product standard and the sample mean measurements for the prototypical petite pattern showed significant differences in back neck to waist length. The prototypical petite pattern, based on the sample mean measurements should have resulted in improved fit for the sample mean. Fit evaluations were also completed to provide additional information.

One of the t-tests, the waist length, back (neck to waist length), comparing sample mean measurements to the voluntary product standard PS 42-70 was significant. Since the absolute value of the test statistic exceeded the corresponding critical value, the probability is less than

Table 7 – T-Test Results of Differences Between the Voluntary product standard PS 42-70, (U.S. Department of Commerce, 1971) and the Sample

Sample Measurements	N	Mean	Sig. (2-tailed)
Bust Circumference	52	37.32	.293
Waist Circumference	52	30.03	.123
Hip Circumference	52	40.60	.426
Waist Length, back (Neck to Waist Length)	50	14.35	.000**
Height	48	8.53	.733

* $p \leq .05$ and ** $p \leq .01$

.01 that the observed sample mean occurred by chance if the hypothesis was true. Therefore, the hypothesis IId was accepted. Additionally, the confidence interval was calculated indicating a 99% confidence level that the corresponding intervals contained the mean of the sampling distributions. This significant finding of the back neck to waist length was supported by previous literature that reported the longitudinal dimension as a vital factor for required in achieving appropriate fit (Tamburrino, 1992a, 1992b). The result also indicated that there is a significant difference between measurements used by the industry to produce apparel and the actual measurements of consumers who wear the apparel. However, hypothesis II a, b, c, and e were rejected.

Hypothesis III

There will be differences between the fit of voluntary product standard PS 42-70 petite muslin proof and the prototypical petite, apple-shaped petite, and pear-shaped petite muslin proof in the

bust, waist and hips, and back neck to waist , and waist to hip as assessed by judges.

Using an instrument developed by the researcher (Judge Fit Evaluation Index, Appendix A), three design professionals evaluated the fit of the muslin proofs on the live models. Each fit model stood individually in front of the panel of judges, who responded to the Judge Evaluation Form (Judge Fit Evaluation Index, Appendix A).

Table 8 – Average Score Given by Judges for Each Muslin Proof

Pattern	A	B	C	D	E	F
Questions	Apple-Shaped	Pear-Shaped	Prototypical Petite	Average-Shaped	VPS 42-70	Corrected Prototypical
Judge 1	4	5	9	11	12	11
Judge 2	6	8	11	9	9	11
Judge 3	15	13	11	12	14	17
Total	25	26	31	32	35	39
Percent	44	46	54	56	61	68
(0 = No and 1 = Yes; Range = 0 – 57, Range of each Judge was from = 1-19)						

The panel of three judges performed visual inspections of the muslin patterns on live fit models and evaluated fit using the Judge Fit Evaluation Index (Appendix A). The scores were summed and then in order to calculate the percent, the sums were divided by 57, the total of the possible scores. Of the six proofs evaluated, four of them had a score of 54% or better (Table 8.) The corrected prototypical petite proof had the highest score with a score of 68%, which demonstrates that the judges' fit evaluation found the corrected prototypical petite pattern proof offered the best fit. The voluntary product standard PS 42-70 had a score of 61%, while the score for the average petite muslin was 56%. The prototypical petite muslin had a mean of 54%, while both the pear-shaped petite proof and apple-shaped petite proof had similar means of 46% and 44%.

Hypothesis IV

There will be differences between the fit of voluntary product standard PS42-70 petite muslin proof and the prototypical petite, apple-shaped petite, and pear-shaped petite muslin proof in the bust, waist and hips, and back neck to waist , and waist to hip as assessed by models.

After modeling, each fit model completed a Model Fit Evaluation Index (Appendix B). Each model was requested to rate overall satisfaction with the fit of the garment. The instrument consisted of a five-point scale, with 1 equal to extreme satisfaction, 3 equal to neutral, and 5 equal to extreme dissatisfaction with the fit of a muslin proof. The results of the satisfaction assessment by the fit models were as follows: the average petite proof was rated as “extremely satisfied”, the prototypical petite proof was rated as “neutral, neither satisfied nor unsatisfied, while the fit models for the apple-shaped, pear-shaped, voluntary product standard PS 42-70, and the corrected prototypical pattern reported they were somewhat dissatisfied with the fit of the muslin. Lastly, the fit model for the apple-shaped muslin reported she was extremely dissatisfied with the fit of the muslin.

Table 9 – Overall Assessment of Fit by Fit Models for Each Muslin Proof

	Apple-Shaped	Average	Pear-Shaped	Prototypical	VPS PS42-70	Corrected Prototypical
Overall	5	1	4	3	4	4
Question 10 Scale 1 = Extremely Satisfied 2 = Somewhat Satisfied 3 = Neutral 4 = Somewhat Dissatisfied 5 = Extremely Dissatisfied						

The rest of the Model Fit Evaluation Index dealt with the assessment of fit. The instrument required models to sit, stand, bend, raise their arms, and complete other movements in order to assess the fit of the garment. The fit models for the apple-shaped, pear-shaped, and corrected prototypical petite proofs reported that the muslin proofs were somewhat tight. Fit

models for the average and the prototypical petite patterns reported their muslin proofs were neutral, neither too tight nor too loose. The fit model for the voluntary product standard PS 42-70 petite proof reported that the muslin was somewhat loose. According to the measurements of the fit model and the minimal amounts of ease required to assure proper movement in a garment, the corrected prototypical muslin proof should have represented proper fit. This was supported by the judges' evaluation.

Table 10 – Average Score Given by Fit Models for Each Muslin Proof

	Activity	Apple-Shaped	Average	Pear-Shaped	Prototypical	VPS PS42-70	Corrected Prototypical
1	Sitting	2	3	2	3	4	2
2	Bending	1	3	2	2	4	2
3	Walking	2	3	2	3	5	2
4	Raised Arms	1	3	2	3	4	2
5	Bust	3	3	3	3	3	3
6	Waist	1	3	3	3	3	2
7	Hip	4	4	2	3	5	3
8	Neck Waist	2	3	3	3	3	3
9	Waist Hip	2	3	3	4	5	2
	Mean	1.8	2.8	2.2	2.7	3.6	2.1
Questions 1 – 9 Scale 1 = Extremely Tight 2 = Somewhat Tight 3 = Neutral 4 = Somewhat Loose 5 = Extremely Loose							

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This exploratory study investigated fit and design with figure type variations for petite women, five feet four inches or under, and between the ages of 20-49. Conclusions are based on data collected from comparison of industry standard measurements to sample measurements, as well as a panel of judges and fit models. Therefore, from the onset, the delimitations excluded the factor of comfort, and relied upon a non-probability sample with a limited number of judges and models.

Statistical analysis revealed significant differences between the industry standard hourglass and the sample mean, with more than half of the sample not meeting the criteria for apple-shaped, pear-shaped, or hourglass as defined by industry standard hourglass definition. Instead, the figure type analysis of the 52 subjects in the sample population yielded the following distribution: 4 apple-shaped, 19 pear-shaped, and 28 average-shaped silhouettes, that failed to fall into any of the three industry definitions.

This demonstrates a need for refined and current sizing standards that accommodate a larger proportion of the population. In addition, the sample mean of this study revealed that the industry standard hourglass silhouette did not accommodate any of the subjects. This might indicate that the population has changed in size (since the standard was established) and a revision of the industry standard hourglass silhouette might result in better fit for more consumers. While the hourglass silhouette is focused on a slender, curved figure, facts indicate that many consumers do not fit into this category. Body dimensions of women have changed drastically within the past decade, with a rising obesity factor, as well as an increasing ethnic population with different figure types (Alexander, 2000; Ashdown, 1998, 2003; U. S. Department of Commerce, 2000; Hisey, 2003; Tamburrino, 1992b, 1992c). As a result, previous

anthropometric industry standards are no longer representative of the current population and are nearly obsolete.

Statistical analysis (t-tests) of the VPS PS 42-70 pattern and the prototypical petite pattern revealed a significant difference in the back neck to waist length. This measurement is one of the most critical measurements. This finding was supported by Tamburrino (1992a), who reported that the longitudinal dimension was key in achieving appropriate fit. More importantly, the finding indicates a significant difference between measurements used by the industry to produce apparel and the actual measurements of consumers who wear the apparel.

Revisions in the back neck to waist length industry measurement, would result in improved fit of petite garments. The VPS PS 42-70 probably does not fit the petite market as well as some of the other categories. This study supports the general idea that apparel industry fit standards no longer fit the population because the size of the consumer has changed in the past years with a rise of the petite population to 47% (Alexander, 2000; Arthur 2003; Ashdown, 1998, 2003; Tamburrino, 1992c; U. S. Department of Commerce, 2000).

Designers, manufacturers, and retailers could benefit from this information when designing, creating, and marketing garments to consumers. Some of the costs incurred because of ill-fitted garments include alterations, garment selection, customer dissatisfaction, and returns (Ashdown, 2003). By refining fit, particularly for a target market such as petite women, the industry could increase profits and overall volume.

Consumers would also benefit if they were aware of the fact that voluntary product standard PS 42-70 measurements are different from their own measurements. This knowledge would assist consumers in purchasing garments that fit appropriately, increase satisfaction with the fit of apparel, and diminish issues with damaging psychological self-imagery (Holzman, 1997; Arthur, 2003).

Judges' assessment of the muslin proofs on the fit models demonstrated that the optimal fit was achieved by the corrected prototypical petite pattern proof. Four of the six proofs had scores of 54% or better. Evaluation of fit of the muslin proofs by the live models had inconsistent results. These findings are supported by the literature regarding the varying perceptions of proper garment fit by consumers due to sizing manipulation (Arthur, 2003; Ashdown, 2003). In retrospect, the question was somewhat arbitrary because it lacked a definition of garment fit. In addition, as reported in the review of literature, consumers often have disparate ideas on how a garment should fit and maybe affected by psychological self-imagery.

Upon evaluation of the voluntary product standard PS 42-70 petite pattern muslin proof, the fit model reported that the muslin was somewhat tight, while she found the opposite with the evaluation of the corrected prototypical petite pattern muslin proof which she reported was mostly loose. However, she stated that she was somewhat dissatisfied with the fit of both muslin proofs. As a result, the live fit model evaluations of the voluntary product standard PS 42-70 petite pattern muslin proof and the corrected prototypical petite pattern muslin proof were inconclusive. A limited number of fit models may have contributed to a lack of conclusive data.

Summary and Conclusions

This exploratory study was undertaken in an effort to determine if voluntary industry standards for women's apparel result in an appropriate fit for female consumers. Since 47 percent of the women in the U.S. between the ages of 20 and 49 are petite (five feet four inches and under), this target market was selected for study. Petite women do not all have the same silhouette, so two figure type variations (apple-shaped and pear-shaped) were included.

Measurements from a proprietary sample were obtained and compared to measurements used by voluntary standard PS 42-70. Mean measurement data were used to create patterns and

muslin proofs that were evaluated for fit by a panel of judges and fit models. Analysis and evaluation of data did not support the voluntary industry standard. The prototype muslin proof, based on sample measurements had a better overall fit than the one based on measurements from the voluntary product standard. The average proof based on the majority of the sample, along with the prototypical apple-shaped and pear-shaped proofs should serve as a starting point for future pattern development.

Current technology provides the necessary tools to improve ready-to-wear fit of garments. Body scanners for size customization, virtual fit assessment, wear testing, and market segmentation information can contribute to a better fit for consumers. With domestic apparel production moving offshore because of less expensive labor, specialization in fit and sizing may be the key to retaining some domestic competitive advantage in the apparel industry (American Textile Manufacturers Institute, 2003; Ashdown, 2003; Pusit, 1998; Tyler, 2004). It would be a tremendous asset to target fit and size problems of large market segments (Kilduff, 2001). In addition, the domestic consumer with a high demand for apparel that fits, is physically available in the U.S. Improvement of fit and sizing systems based on current population studies could be financially beneficial to domestic apparel firms (Ashdown, 2003).

Recommendations and Implications

Pattern development of the prototypical petite pattern would have been more streamlined if the Standard Measurement Chart, size 16 (Armstrong 2006, pp. 30-60) had been used instead of the voluntary product standard PS 42-70 for the Misses Petite, size 16P. The pattern development process may have been more efficient if the sample mean measurements had been used as a base instead of those in the Standard Measurement Chart (Armstrong 2006, pp. 30-60). The researcher would not recommend modifying the voluntary product standard PS 42-70 petite pattern to develop the misses petite pattern. In going through much iteration, some accuracy was

lost. It may have been beneficial to determine opinions on desired fit from fit models prior to their evaluating the muslin proof and to provide fit models with specific definitions regarding proper fit. Collection of data for future studies should include additional measurements used in Armstrong (2006, pp. 30-60) for more accurate patternmaking.

For future study, other groups of subjects could be measured and investigated. Of particular interest would be subjects in other regions of the country or samples with ethnic diversity with figure type variations. Subjects could be both measured and scanned during the same time period for comparison of accuracy in data collection. It would enable immediate pattern production, three-dimensional body shape analysis, and quicker classification of body figure types. In addition, the subjects could benefit from receipt of copies of their personal pattern work.

Implications of this study for fitting petite women with figure type variations are important to the apparel industry including designers, manufacturers, and retailers. Improved patternmaking, grading, sizing, production, fit, marketing, and global competitiveness are all beneficial to the apparel industry (American Textile Manufacturers Institute, 2003; Ashdown, 2003; Pusit, 1998; Tyler, 2004). In addition to refining fit and increasing customer satisfaction, when information regarding fit is applied in the design and manufacture of apparel, it can result in reduced costs associated with consumer dissatisfaction, lost sales, returns, and alterations (Ashdown, 2003).

Current standards regarding fit and apparel design for petite women are not aligned with the various figure-type variations that have developed in today's market (Alexander, 2000; Arthur 2003; Ashdown, 1998, 2003; Tamburrino, 1992c). As a result, women, especially petite women, struggle to find clothes that fit appropriately (Shim and Bickle, 1993; Goldsberry, Shim, and Reich, 1996; Campbell and Horne, 2001; Hisey, 2003; The long and short of it all 2003, p.

1). Patterns developed in this study offer a starting point for future research involving the development of patterns that address fit and figure-type variations.

REFERENCES

- Alexander, M. (2000). *Understanding the fit preferences of young female consumers through body cathexis, clothing benefits sought and demographics based on different body shapes*. Auburn University: Thesis, Auburn University Libraries RBD, Interlibrary Loan, Louisiana State University Library.
- Amaden-Crawford, C. (1996). *The art of fashion draping* (2nd ed.). New York: Fairchild Publications.
- American Textile Manufacturers Institute (2003). *Textile HiLights*. [Electronic version]. Retrieved November 26, 2003, from <http://www.atmi.org>
- Armstrong, H. J. (1995). *Patternmaking: For fashion design* (2nd ed.). New York: HarperCollins College Publications, pp. 45-75.
- Armstrong, H. J. (2006). *Patternmaking: For fashion design* (4th ed.). New Jersey: Pearson Education, Inc., pp. 30-60.
- Arthur, K. (2003, May 18). Sizes give us fits. *The Pantagraph*, p. G1, pp. 1-4.
- Ashdown, S. P. (1998). An investigation of the structure of sizing systems: A comparison of three multidimensional optimized sizing systems generated from anthropometric data with the ASTM standard D5585-94. *International Journal of Clothing Science and Technology*, 10(5), 324-341.
- Ashdown, S. P. (Spring 2003). Sizing up the apparel industry. *Cornell's Newsletter: Topstitch*.
- Betzina, S. (2001). *Fast fit*. Easy pattern alterations for every figure. Newton, CT.: Jim Childs.
- Brackelsberg, P., Farrell-Beck, J., & Winakor, G. (1986). Comparing fit of basic bodices and skirts altered by traditional and experimental techniques. *Clothing and Textiles Research Journal*, 5(1), 34-41.
- Brackelsberg, P. & Marshall, R. (1994). *Unit method of clothing construction* (7th ed.). Ames, IA: Iowa State Press, 12-17, 30-33, 45-47.
- Campbell, L. D. & Horne, L. (2001). Trousers developed from the ASTM D5586 and the Canada standard sizing for women's apparel. *Clothing and Textiles Research Journal*, 19(4), 185-193.
- Goldsberry, E., Shim, S. & Reich, N. (1996). Women 55 years and older: Part 1. Current body measurements as contrasted to the PS42-70 data. *Clothing and Textiles Research Journal*, 14(2), 108-119.
- Hebert, R. R. (1994). *Improving garment fit for the mature female*. Louisiana State University: Thesis & Dissertation Collection database.

- Hisey, P. (2003). Is there any such thing as a regular size anymore? *Retailer Merchandiser*, 43 (3), 24.
- Holzman, D.C. (1997). Fewer sizes fit all. *Technology Review*, 99(1), 19-21.
- Horridge, P.E. & Woodson, E.M. (1988). Apparel sizing solutions for an ageing problem. *Journal of Consumer Studies and Home Economics*, 12, 277-288.
- Institute for Standards Research (1993). *Development of body measurement tables of women age 55 and older and the relationship to ready-to-wear garment size* (ISR-06 PCN: 33-000006-18). Philadelphia: ASTM Institute for Standards Research.
- Iowa State University, University Extension. (February 2003). *Unraveling the Mystery of Design Elements and Principles in Clothing*. [Electronic version]. Retrieved July 1, 2004, from <http://www.extension.iastate.edu/Publications/4H313.pdf>
- Kilduff, P. (2001). Outlook for the U.S. Apparel Industry, *Textile Outlook International*.
- Kinley, T.R. (2003). Size variations in women's pants. *Clothing and Textiles Research Journal*, 21(1), 19-31.
- Lai, S.S. (2002). Objective evaluation for the comfort of free movement of a narrow skirt. *Clothing and Textiles Research Journal*, 20(1), 45-52.
- Lang, S. (1996). Apparel designers develop clothing to fit older women. *Human Ecology*, 24(3), 3.
- Lee, Y. T. (1994). *Body Dimensions for Apparel*, NISTIR 5411, National Institute of Standards and Technology, Gaithersberg, MD.
- Little Women. (January 15, 2001). *People*, 55(2), 23. [Electronic version]. Retrieved October 28, 2003, from, http://libezp.lib.lsu.edu:2444/DeliveryPrintSave.asp?tb=1&_ug=dbs+0...
- Manuel, M. B. (2000). *Understanding the Apparel Fit Preferences of Black Professional Women*. Auburn University: Thesis, Auburn University Libraries RBD, Interlibrary Loan, Louisiana State University Library.
- Martin, R. & Koda, H. (1995). *Haute Couture, New York: The Metropolitan Museum of Art*, 33.
- McCulloch, C. E., Paal, B., & Ashdown, S. P. (1998). An optimisation approach to apparel sizing. *Journal of the Operational Research Society* 49, 492-499.
- Patterson, C.A., & Warden, J. (1983-84). Selected body measurements of women aged sixty-five and older. *Clothing and Textiles Research Journal*, 2(2), 23-30.
- Pusit, G. R. (1998). *Summary of Mass Customization: profiling consumer interest*. Auburn

University: Thesis, Auburn University Libraries RBD, Interlibrary Loan, Louisiana State University Library.

One size fits few. (Fall, 2004). *Mizzou*, 8.

Oxford English Dictionary, 1989. (2nd ed.). [Electronic version]. Retrieved December 2, 2003, from, http://libezp.lib.lsu.edu:2078/cgi/entry_main/00009441?query_type=w...

Seeling, C. (1999). *Fashion: The Century of the Designer 1900-1999*, Italy: Konemann, 13.

Shim, S., & Bickle, M. C. (1993). Women 55 years and older as catalog shoppers: Satisfaction with apparel fit and catalog attributed. *Clothing and Textiles Research Journal*, 11(4), 53-64.

Swan, J.E. & Combs, L.J. (1976). Product performance and consumer satisfaction: A new concept. *Journal of Marketing*, 40, 25-33.

Tamburrino, N. (1992a). Apparel Sizing Issues, Part 1. *Bobbin*, 33(8), 44-59.

Tamburrino, N. (1992b). Apparel Sizing Issues, Part 2. *Bobbin*, 33(9), 52-60.

Tamburrino, N. (1992c). Sized to sell. *Bobbin*, 68-74.

The Fashion Index, Inc. (2004). *The Apparel Design & Production Hand book*. [Electronic version]. Retrieved July 1, 2004, from <http://www.fashionindex.com/mfg/womens>

The long and short of it all. (August 15, 2003). *Nottingham Evening Post*. Retrieved October 28, 2003, from, http://libezp.lib.lsu.edu:2054/universe/document?_m=f2c97a6108f2a6...

Tortora, P. G. & Eubank, K. (1998). *Survey of Historic Costume* (3rd ed.). New York: Fairchild Publications, 256-257, 379, 392, 424-455.

Tyler, K (2004, Spring). Measure for measure. *Kaleidoscope*. [Electronic version]. Retrieved August 29, 2004, from, <http://www.che.umn.edu/news/publications/kaleidoscope/s04kaleidoscope.html>

Tyrangiel, J. (September 17, 2001). Spree school. *Fortune*, 144, 250-252.

U. S. D. A. Miscellaneous Publication (1941), Women's Measurements for Garment and Pattern Construction, 454, Retrieved November 28, 2004, from, <http://museum.nist.gov/exhibits/apparel/role.htm>

U. S. Department of Commerce. (1971). Voluntary product standard PS 42-70. Body measurements for the sizing of women's patterns and apparel. Washington, D. C.: U.S. Government Printing Office.

U. S. Department of Commerce, Bureau of the Census (2002). Statistical abstract of the United States. Washington, D. C.: U.S. Government Printing Office.

Waugh, C.F. (1999). Well-cut through the body: Fitted clothing in twelfth-century Europe. *Dress*, 26, 3-17.

Winter, M. (August, 2003). High Technology in the apparel industry. *Human Ecology*, 11-16.

Yoo, S. (2003). Design Elements and Consumer Characteristics Relating to Design Preferences of Working Females. *Clothing and Textiles Research Journal*, 21(2), 49-62.

APPENDIX A
JUDGE FIT EVALUATION INDEX

JUDGE FIT EVALUATION INDEX

						1	2
						Yes	No
A. Prototype	A	B	C	D	E	F	(circle the prototype label)
1. Vertical grainlines hang straight and perpendicular to the floor.							1 2
2. Sideseams hang straight and perpendicular to the floor.							1 2
3. Crossgrains are parallel to the ground: (bustline, shoulder blade, capline, and hipline)							1 2
4. The garment hemline is even and parallel to the floor.							1 2
5. The garment hangs freely without any pulling or twisting.							1 2
6. The overall look of the garment is neat and pressed.							1 2
7. Darts point to and end one inch before fullest part of the bust.							1 2
8. The garment has no vertical or horizontal wrinkles.							1 2
9. The center back closure meets without any pulling or gapping.							1 2
10. Appropriate length between the neckline and waistline.							1 2
11. Appropriate length between the waistline and hipline.							1 2
B. Appropriate amount of ease across the:							
						12. Bustline	1 2
						13. Waistline	1 2
						14. Hipline	1 2
C. Appropriate placement of the:							
						15. Bustline	1 2
						16. Waistline	1 2
						17. Hipline	1 2
						18. Neckline	1 2
						19. Capline	1 2

(Based on Amaden-Crawford, 1996, p. 48; Betzina, S. 2001, pp. 6-7)

APPENDIX B

MODEL FIT EVALUATION INDEX

MODEL FIT EVALUATION INDEX

Prototype: A B C D E F (circle the prototype label)

Please circle the most appropriate response based on the corresponding scale.

1	2	3	4	5
Extremely Tight	Somewhat Tight	Neutral	Mostly Loose	Extremely Loose

A. Describe the fit of the garment while:

1. Sitting	1	2	3	4	5
2. Bending	1	2	3	4	5
3. Walking	1	2	3	4	5
4. Arms are raised above the head	1	2	3	4	5

B. Describe the fit of the garment across the:

5. Bust area	1	2	3	4	5
6. Waist area	1	2	3	4	5
7. Hip area	1	2	3	4	5

C. Describe the fit of the garment in the area between:

8. The neck and the waist	1	2	3	4	5
9. The waist and the hip	1	2	3	4	5

1	2	3	4	5
Extremely Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Extremely Dissatisfied

10. Overall, how satisfied are you with the fit of the garment?	1	2	3	4	5
---	---	---	---	---	---

(Based on Amaden-Crawford, 1996, p. 48; Betzina, S. 2001, pp. 6-7)

APPENDIX C

**LSU INSTITUTIONAL REVIEW BOARD
FOR HUMAN RESEARCH
SUBJECT PROTECTION APPROVAL**

IRB #: 2797 LSU Proposal #: _____ Revised: 03/24/2004

LSU INSTITUTIONAL REVIEW BOARD (IRB) for 578-8692 FAX 6792
HUMAN RESEARCH SUBJECT PROTECTION Office: 203 B-1 David Boyd Hall

Study exempted by
Louisiana State University
Institutional Review Board
203 B-1 David Boyd Hall
225-578-8692

Unless they are qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research involving living humans as subjects, or samples or data obtained from humans, directly or indirectly, without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

Instructions: Complete this form.

Exemption Applicant: If it appears that your study qualifies for exemption send:

- (A) Two copies of this completed form,
- (B) a brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts A & B),
- (C) copies of all instruments to be used. If this proposal is part of a grant proposal include a copy of the proposal and all recruitment material.
- (D) the consent form that you will use in the study

to: ONE screening committee member (listed at the end of this form) in the most closely related department/discipline or to IRB office.

If exemption seems likely, submit it. If not, submit regular IRB application. Help is available from Dr. Robert Mathews, 578-8692, irb@lsu.edu or any screening committee member.

Principal Investigator Dr. Bonnie Belleau Student? N Y/N

Ph: (225) 578-1703 E-mail hcbell@lsu.edu Dept/Unit Human Ecology

If Student, name supervising professor _____ Ph: _____

Mailing Address _____ Ph _____

Project Title Petite Women: Fit and Body Shape Analysis

Agency expected to fund project Not Applicable

Subject pool (e.g. Psychology Students) LSU Students & Women from General Public 20-49

Circle any "vulnerable populations" to be used: (children <18; the mentally impaired, pregnant women, the aged, other). Projects with incarcerated persons cannot be exempted.

I certify my responses are accurate and complete. If the project scope or design is later changed I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted.

PI Signature [Signature] Date 11-10-04 (no per signatures)

Screening Committee Action: Exempted ☒ Not Exempted ☐ Category/Paragraph _____

[Signature] [Signature] 11/11/04

VITA

Lisa Barona McRoberts was born in Baton Rouge, Louisiana, on September 15, 1965. In 1988, she completed a paralegal certificate at Louisiana State University, in Baton Rouge, Louisiana. In May, 2000, she completed her Bachelor of Science with a concentration in apparel design at Louisiana State University, in Baton Rouge, Louisiana.

Prior to graduation in April, 1999, Lisa Barona McRoberts started a successful custom couture business in Baton Rouge, Louisiana. In August, 2002, she returned to Louisiana State University in Baton Rouge, Louisiana to pursue a Master of Science in human ecology with a concentration in apparel design. From the onset of her graduate studies, Lisa Barona McRoberts worked as a graduate assistant for her major professor, Dr. Bonnie Belleau, and Yvonne Marquette. She was encouraged in her teaching endeavors through in-class participation with students. The experience helped prepare her for her future career. Additionally, she interned with Vera Wang in New York City, where she was further educated in the application of apparel design in the industry.